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BENNETT (C. W.) & WALLACE (H. E.). **Relation of the curly top virus to the vector, Eutettix tenellus.**—*J. agric. Res.*, lvi, 1, pp. 31–51, 3 graphs, 1938.

In continuation of this series of studies on the curly top virus of sugar beet [*R.A.M.*, xvi, p. 650; xvii, p. 153] the authors give an account of experiments, the results of which showed that the vector, *Eutettix tenellus*, is able to pick up the virus in one minute's feeding on curly top beets, and that viruliferous individuals can transmit it to healthy plants in one minute's feeding on them; the shortest time, however, in which a leafhopper was able to pick up the virus and transmit it was four hours. Sufficient virus was acquired by non-viruliferous individuals in two days' feeding on diseased beets to give them their maximum infective capacity, but the maximum possible charge of virus (as gauged by inoculation tests with extracts from the leafhoppers) was only attained after longer feeding periods. Fasting for 18 hours prior to feeding on healthy plants decreased the percentage infection produced by viruliferous leafhoppers in the first two 6-minute periods of feeding; the percentage was higher after fasting periods of 15 minutes to 3 hours than after fasts of one to 6 minutes or over 3 hours. Special tests indicated that the virus is present in the blood, salivary glands, alimentary tract, and faeces of infective *E. tenellus*, and is most abundant in the blood. Further experiments showed that both virus content and infective capacity decreased gradually over periods of 8 to 10 weeks, regardless of the initial charge of virus, in viruliferous leafhoppers confined to a very resistant or immune plant, such as the Australian saltbush (*Atriplex semibaccata*) or sweet corn, and that leafhoppers with a low charge of virus, acquired in six hours' feeding on an extract from viruliferous individuals, lost their infective power after 54 days of daily transference to healthy beet seedlings; such individuals, however, regained their infective capacity after a very short feed on diseased beets. These facts are held to prove that if there is any multiplication of the virus in the leafhopper, it is not sufficient to maintain the original virus content, the probability being that the virus does not multiply in the insect. Considerable variations were noted in the capacity of different individuals to transmit the disease, and it was found possible by selective breeding to produce *E. tenellus* strains with higher or lower capacity of transmission than normal. As yet, however, there is no evidence that individuals inherently incapable of transmitting the virus can be developed.

In a separate series of experiments it was shown by test inoculations with extracts from macerated insects that the curly top virus is picked up by eight other species [which are listed] of non-vector insects, and is retained by them for periods ranging from less than one day (*Hercothrips femoralis*) to 21 days (*Aceratagallia californica*) after transference to healthy plants.

LE CLERG (E. L.). **Further studies on the parasitism of Rhizoctonia solani on Sugar Beets.**—*Phytopathology*, xxviii, 2, pp. 152–153, 1 fig., 1938.

Three strains of *Rhizoctonia* [*Corticium*] *solani* isolated from severely damaged potato sprouts in Minnesota and Louisiana in 1935 and 1936 caused appreciable decay of sugar beets [*R.A.M.*, xvii, p. 366] in inoculation experiments, while 25 others induced less extensive rotting. Negative results were given, however, by 116 isolates of the fungus from older potato plants and from sclerotia on the tubers.

JAUCH (CLOTILDE). **Las dos especies de Septoria que atacan el Apio cultivado en la República Argentina.** [The two species of *Septoria* attacking cultivated Celery in the Argentine Republic.]—*Rev. argent. Agron.*, iv, 4, pp. 258–272, 1 pl., 6 figs., 1 graph, 1937.

An account is given of experimental studies the results of which showed that in the Argentine the disease of celery commonly known as 'viruela' [measles] is caused by *Septoria apii* and *S. apii-graveolentis* [*R.A.M.*, xii, p. 196; xvi, p. 584], the latter being the more prevalent, although both organisms may occur on one and the same plant. The leaf spots caused by *S. apii* are irregular, whitish or greyish, surrounded by a reddish-black zone or a narrow dark margin; their size varies from 3 to 10 mm.; when present the pycnidia are only found in the centre of the spots on either side of the leaf, as extremely minute blackish points. Apart from their much smaller size (0·5 to 3·5 mm.), the spots produced by *S. apii-graveolentis* are easily distinguishable macroscopically from the former by the constant presence over the whole of their surface of conspicuous pycnidia, closely crowded together, while those of *S. apii* are mainly isolated. Furthermore, the latter has never been observed to attack the leaf petiole, while this organ remains free from infection with *S. apii-graveolentis* only in the initial stages of the disease or in the case of very slight attack. The pycnidia of *S. apii* are mostly globose, and from 58 to 95 μ in diameter, while those of *S. apii-graveolentis* are usually subglobose and 60 to 149 μ in diameter; the pycnospores of the former measure 11 to 43 (mode 29, average 27·4) by 1 to 2·5 μ, and those of the latter 17 to 61 (mode 35, average 36·8) by 1·5 to 3 μ. In hanging drop cultures (potato broth with 2 per cent. glucose) *S. apii* formed a distinctly narrower and more sparsely septate mycelium than *S. apii-graveolentis*, and when transferred to potato agar with 2 per cent. glucose and incubated at 22° C., the former produced larger colonies, bituminous black in the centre with a peripheral pink zone, the whole of the colony sometimes being covered with white cottony mycelium, whereas the latter formed much smaller colonies with a central mass of pycnidia.

Inoculation experiments with monospore cultures indicated that none

of the commercial celery varieties tested was resistant to either species, but the 'para verdeo' variety showed rather less infection than the rest. Neither species was pathogenic to parsley.

ZWEIGELT (F.) & VOBORIL (F.). **Die Markkrankheit der Rebe.** [The pith disease of the Vine.]—Reprinted from *Weinland, 1937*, 4–9, 14 pp., 2 diags., 1937. [Received June, 1938.]

Full details are given of a series of inoculation experiments carried out on 62 vines grafted by various methods at Klosterneuburg, Austria, with a fungus, M, consistently associated with the pith disease but differing in certain particulars from *Pumilus medullae* [*R.A.M.*, xvi, p. 587; xvii, p. 432]. The organism is characterized by excessively slender hyphae which traverse the host cells in an almost straight line, with little or no tendency to branching. At a more advanced stage of infection these hyphae may increase in diameter and form a dense network on the inner surfaces of the cell walls, where they give rise to more or less spherical, hyaline, very thin-walled, bicellular spores, which eventually fill the cells. To the same fungus probably belong small, thick-walled, circular spores, occurring here and there in the diseased tissues. In association with M is another fungus, herein referred to as N, the hyphae of which pursue an interrupted or sinuous course through the cells.

The fungus M, either alone or in combination with N, caused virulent infection of the inoculated vines, invariably resulting in death. In nature entry is most likely gained through the zone surrounding the graft union, and in this connexion some practical directions are given for the technique of grafting operations, involving, *inter alia*, the use of stocks and scions with thick, fully matured xylem and a narrow zone of pith.

DU PLESSIS (S. J.). **The dead-arm disease of the Vine.**—*Fmg S. Afr.*, xiii, 143, pp. 79–80, 83, 4 figs., 1938.

A popular account is given of the dead-arm disease of the vine (*Fusicoccum viticolum*) [*Cryptosporella viticola*: *R.A.M.*, xvii, p. 288], which was brought to the writer's notice in 1935. It chiefly attacks the Riesling, Sultana, Barbarossa, and Flaming Tokai varieties in the Stellenbosch, Somerset West, and Capetown districts. In addition to cultural measures of control, the vines should be given a dormant application of 1 in 8 lime-sulphur, followed by three treatments of the same compound at 1 in 120: (1) and (2) when the shoots are 2 to 4 and 6 to 10 in. long, respectively, (3) just before or during flowering. Copper-sulphur dust or verderame spray (1 lb. in 10 galls. water) may also be used, but are less effective than lime-sulphur.

DU PLESSIS (S. J.). **The control of Botrytis rot of Grapes.**—*Fmg S. Afr.*, xiii, 143, pp. 81–83, 1938.

The results of the 1937 investigations on the control of *Botrytis* [*cinerea*] wastage in South African export grapes [*R.A.M.*, xvii, p. 470] showed that the best and safest method consists of a single vineyard application of verderame-sulphur dust (80: 20), 14 to 21 days before picking, supplemented preferably by the fumigation of susceptible

varieties with a 4 per cent. concentration by volume of formaldehyde gas, or (where facilities for this process are not available) by spraying the woodwool of each box with 10 c.c. 4 per cent. formalin.

SAINT-CHARLES (R. DE). **Pour obtenir une bouillie mouillante.** [To obtain a wetting mixture.]—*Vie agr. rur., 1938*, N.S., 1, pp. 16–17, 1938.

The writer advocates the addition of the following adjuvants to the standard Bordeaux mixture for the combined control of insects and downy mildew of the vine [*Plasmopara viticola*] in France: diplumbic lead arsenate (500 to 600 gm. per hectol.) and terpenic sulphonated alcohols [*R.A.M.*, xvii, p. 194], known commercially as novemol [ibid., xvii, p. 375], 100 to 200 gm. per hectol., the latter conferring excellent wetting properties on the mixture. A minimum of three applications should be made (1) at flowering, (2) 15 to 20 days later, and (3) 15 days before harvesting. In a footnote it is stated that novemol is also effective against *Oidium* of the vine [*Uncinula necator*], exerting a preventive action when mixed with copper salts and a therapeutic one when simply diluted with water.

STRAŇÁK (F.). **Choroby a poškození kulturních rostlin v Čechách ve vegetačním období 1936–1937.** [Diseases of, and injuries to, cultivated plants in Bohemia during the agricultural year 1936–7.]—*Ochr. Rost.*, xiv, 55, pp. 1–4, 1938. [German summary.]

In this briefly annotated list of the most important diseases of cultivated crops in Bohemia, Czechoslovakia, in 1936–7, rye is stated to have suffered very severely from foot rots (*Fusarium* spp.) and from black rust [*Puccinia graminis*], and barley from stripe disease [*Helminthosporium gramineum*]. Heavy outbreaks of potato late blight (*Phytophthora infestans*) were recorded and wart disease [*Synchytrium endobioticum*] was found in several new centres in south, north, and west Bohemia.

Among minor crops, cucumbers were attacked very severely in certain localities by bacterial wilt (*Bacillus tracheiphilus*) [*Erwinia tracheiphila*].

BAUDYŠ (E.). **Zpráva o výskytu chorob a škůdců rostlin v hospodářském roce 1936–1937 na Moravě.** [Report on the incidence of plant diseases and pests in the agricultural year 1936–7 in Moravia.]—*Ochr. Rost.*, xiv, 55, pp. 4–8, 1938. [German summary.]

In 1936–7 autumn-sown cereals suffered severely in Moravia (Czechoslovakia) from foot and root rots (*Fusarium* spp.). Wheats were attacked chiefly by brown rust (*Puccinia triticina*) and to a lesser extent by black rust (*P. graminis*), and barley by stripe disease [*Helminthosporium gramineum*]. Fruit trees throughout Moravia were extensively attacked by various fungal parasites, and in the autumn unharvested grapes in certain localities were severely rotted by *Botrytis cinerea*.

VIELWERTH (V.). **Zpráva o škodlivých činitelích kulturních rostlin v oblasti západního a středního Slovenska.** [Report on the agencies injurious to cultivated plants in western and central Slovakia.]—*Ochr. Rost.*, xiv, 55, pp. 8–16, 1938. [German summary.]

Cereal crops in western and central Slovakia suffered in 1936–7 from

much the same fungal diseases and to an equal extent as in other parts of Czechoslovakia [see preceding abstracts]. Wheat bunt (*Tilletia caries* and *T. foetens*) was, however, less prevalent and less severe than in previous years, and *T. caries*, which occurs alone in the northern districts, did not reach so far south as usual. Stone fruit trees were exceptionally heavily attacked by *Monilia* [*Sclerotinia*] *laxa*, and *M.* [*S.*] *fructigena*; the attack was particularly severe on apricots [see below, p. 536], and observations indicated that the condition was an important factor in the death of an exceptionally large number of young apricot trees from apoplexy, which is stated to be very prevalent in Slovakia. *Botrytis cinerea* was widespread on ripening grapes, the losses caused by it in many localities being estimated at as much as 30 per cent. of the crop [cf. above, p. 499, and preceding abstract].

ŠEDA (A.). **Zpráva o škodlivých činitelích kulturních plodin na východ. Slovensku a Podkarpat. Rusi za hospodářsky rok 1936–37.** [Report on the agencies injurious to cultivated crops in eastern Slovakia and Carpathian Ruthenia in the agricultural year 1936–37.] —*Ochr. Rost.*, xiv, 55, pp. 16–23, 1938. [German summary.]

To judge from this report the incidence and relative importance of diseases of the main cultivated crops in east Slovakia and Carpathian Ruthenia in 1936–7 were much the same as elsewhere in Czechoslovakia [see preceding abstracts]. Potato wart [*Synchytrium endobioticum*] was observed in five new infected areas in the mountain districts of Carpathian Ruthenia.

Plant diseases.—*Rep. Dep. Agric. Punjab, 1936–7*, pp. 52–56, 1938.

During the period under review the gram [*Cicer arietinum*] crop in the Attock District of the Punjab was entirely destroyed by blight [*Ascochyta rabiei*: *R.A.M.*, xv, p. 198] in spite of the destruction or burying of all diseased material from previous crops and the sowing of clean seed. These methods had proved completely effective during the previous three years, but were nullified on this occasion by fresh infection brought in from neighbouring localities by wind and other agencies. No sanitary measures had been adopted in Hazara and Peshawar, and when climatic conditions strongly favour blight, rigorous sanitation cannot save a particular area from subsequent infection from outside tracts where the disease is allowed to develop freely. Three varieties from France were strongly resistant to the attack, and are to be used in breeding work.

Sugar-cane smut [*Ustilago scitaminea*: ibid., xvi, p. 232] has been virtually eliminated at Risalewala by avoiding the planting of setts from affected canes, discouraging the ratooning of affected canes, disinfecting the setts before planting, and roguing out diseased shoots directly they appear.

The fungus responsible for cotton root rot [*Macrophomina phaseoli*: ibid., xvii, p. 34] has now been isolated and identified. Control would appear to be possible by late sowing. Fungal activity first becomes apparent in the wilting of the plants in mid-June, increases up to mid-July, and then gradually diminishes until it finally ceases at the end of September. Infection appears before irrigation is started, but

afterwards becomes much worse, moisture being necessary for the active existence of the parasite. Sowing experiments in badly infected land showed a steady diminution in the severity of the disease with progressive postponement of the sowing date. Plots sown on 25th June gave 4½ to 5¼ maunds [369 to 430 lb.] of kapas [*Gossypium herbaceum*] per acre, as against only 1½ maunds [123 lb.] for plots sown on 7th May, the former showing only 4·4 per cent. mortality. This discovery, if verified, will provide means of controlling the disease in badly affected fields.

OSMUN (A. V.). **Department of Botany.**—*Rep. Mass. agric. Exp. Sta., 1937* (*Bull.* 347), pp. 29–37, 1938.

This report [cf. *R.A.M.*, xvi, p. 658] contains the following items of interest. In search of better methods of soil disinfection with old and new disinfectants in the control of diseases of herbaceous ornamentals, W. L. DORAN found that undiluted vinegar worked into or mixed with the soil immediately before seeding at the rate of 200 to 235 c.c. per sq. ft. continued to give satisfactory control of damping-off. The acetic acid (4 per cent.) contained in vinegar seemed, however, to injure crucifers, whereas about 8 c.c. acetic acid (80 per cent.), diluted to 300 c.c. per sq. ft., caused no injury to any of the species of plants tested when seeds were sown immediately after application. Seven c.c. formic acid (90 per cent.), diluted to 300 c.c. per sq. ft. and mixed with the soil immediately before seeding, gave very good control of damping-off, improved germination, and did not interfere with growth; the operator must take care to avoid injury to the skin. An application of 6 to 8 gm. salicylic acid per sq. ft. was usually found to improve germination in the presence of fungi. An application of undiluted pyroligneous acid, made from pine wood, at the rate of about 125 c.c. per sq. ft. immediately before seeding gave good control of damping-off without injury to any of the species tested.

Investigations on the chemical soil treatment against damping-off of vegetables, conducted by W. L. DORAN and E. F. GUBA, showed that the application of chemicals to the soil after seeding was in most cases injurious to seeds. The application of formalin, 1 in 300, at the rate of 1½ pt. per sq. ft., immediately after seeding controlled most of the early damping-off, and was not injurious to tomato, eggplant, pepper [*Capsicum annuum*], or lettuce, although it did injure cress, the only crucifer tested. Vinegar (175 c.c. per sq. ft.) diluted with an equal volume of water, applied after seeding was injurious to cabbage; 220 c.c. per sq. ft. applied in a similar way was not harmful to pepper or several species of *Opuntia* but is not safe for most plants. When different chemical powders were dusted on seed-beds sown with lettuce and cabbage, after firming the soil over the seed, and again upon emergence, the stand of lettuce was improved 11 per cent. over the check with red copper oxide [ibid., xvii, p. 445], 5 per cent. with basi-cop, 1·6 per cent. with vasco, 6 per cent. with calomel [mercurous chloride], 2 per cent. with a 20–80 monohydrated copper-lime dust, and that of cabbage 18 per cent. with vasco, 10 per cent. with zinc oxide, and 15 per cent. with a 20–80 copper-lime dust.

According to the results obtained by E. F. GUBA and C. J. GILGUT in control of apple scab [*Venturia inaequalis*: ibid., xvii, p. 118 and

below, p. 534] the coarsest and the finest wettable sulphurs gave the poorest and the best control, respectively, and severe injury to the foliage was caused only by liquid lime-sulphur. Of the five brands of wettable sulphur compared with the official spray schedule of liquid lime-sulphur and wettable sulphur, linco [ibid., xiv, p. 684] (containing 55 per cent. sulphur) produced no scabby apples, Hood (98·5 per cent. sulphur) 13·3 per cent., magnetic (98·5 per cent. sulphur) 23·8 per cent., flotation (40 per cent. sulphur) 2·5 per cent., and kolofog (30 per cent. sulphur) 8·3 per cent.

The same workers recommend the following seed disinfectants for controlling damping-off of vegetables: red copper oxide for beet, carrot, cucumber, eggplant, lettuce, muskmelon, pepper, spinach, squash, and tomato; semesan for snap beans [*Phaseolus vulgaris*], cabbage, cauliflower, maize, onion, and pea; and zinc oxide for Lima beans [*Phaseolus lunatus*], parsnip, radish, and turnip.

Fiftieth Annual Report of the Kentucky Agricultural Experiment Station for the year 1937. Part I.—67 pp., 1938.

The following items occur in this report [cf. *R.A.M.*, xvi, p. 657]. Blue mould of tobacco (*Peronospora tabacina*) [ibid., xvii, p. 275] is reported for the first time to have caused extensive injury to tobacco beds in Kentucky.

For over ten years tobacco mosaic was controlled on the experimental fields by directing the workmen to use no barn-cured tobacco and to brush out their pockets and wash their hands before handling plants and while setting. In 1937 it was found that 0·55 per cent. mosaic developed when workmen used no barn-cured tobacco throughout the season, 1·6 per cent. when they used it only after setting, and 20·9 per cent. when they smoked or chewed it all the time.

In 1937 a disease similar to brown root rot [see below, p. 560] as described in other States was unusually prevalent in all types of tobacco. Rapid growth did not begin before about 1st August, after which the recovery was remarkable. Different varieties of White Burley tobacco varied considerably in their resistance to the disease, and plants grown on land on which a heavy bluegrass [*Poa pratensis*] sod had been turned under showed little or no disease.

Farm tests of White Burley No. 16 seem to indicate that this new hybrid is more resistant to black root rot [*Thielaviopsis basicola*: ibid., xiv, p. 685 and below, p. 560] than the resistant No. 5, yields 200 lb. more per acre, and is of good quality.

The addition of thallium to sand and water cultures in which Turkish and Burley tobacco plants were growing resulted in varying degrees of chlorosis, which did not, however, appear to be identical with frenching [ibid., xvi, p. 412].

Plant pathology.—*Rep. Ariz. agric. Exp. Sta., 1936–7*, pp. 77–91, 5 figs., 2 diags., 2 graphs, [? 1937. Received May, 1938].

This report includes the following items of interest [cf. *R.A.M.*, xiv, p. 561]. Angular leaf spot of cotton (*Phytomonas malvaceara*) [*Bacterium malvacearum*: ibid., xvii, p. 455] is stated to overwinter in Arizona in the field only on the lint. Delinting with sulphuric acid

applied by machine entirely eliminated the disease and led to quicker germination of the seed (whether selected or gin-run), especially after additional dusting with ceresan, greater ease in handling, planting, and storing of seed, and elimination of 'chopping', while less seed was required per acre.

Verticillium albo-atrum (? *V. dahliae*), isolated from cotton [ibid., xvii, p. 455] from the Safford district, is believed to be the primary cause of wilt in spite of the presence of *Fusarium* in the infected material. Field observations strongly point to seed-borne infection since the disease is apparently not transmitted by soil. Discoloured vascular strands were traced from the roots to the bolls.

No recurrence of the leaf spot of date and other palms caused by *Graphiola* [*phoenicis*: ibid., xvi, p. 23 and below, p. 507] is reported from the date garden near Tempe, which was burned to eradicate the disease. Most of the larger palms and offshoots have survived the burning. Pruning and spraying were found to control the disease in plantings of commercial varieties. In inoculation experiments the incubation period lasted 4½ to 6 months. The scarcity of the disease in date gardens with good aeration indicated that the prevailing low humidity reduces the prevalence of *Graphiola* in the date-growing sections of the State. The effect of spring spraying of date palms for the control of fruit rot caused by various fungi was quite evident on the leaves but showed little difference on the fruit except for the Berhi (Braim) variety. It is concluded that two or more sprayings might well repay the cost.

Both experimental and field tests indicated that for soil treatment ammonium phosphate is superior to ammonium sulphate, which is stated to be at present widely and successfully used in southern Arizona against the *Phymatotrichum* [*omnivorum*] root rot [ibid., xvii, p. 316] of ornamental trees and shrubs. The soil treatment has proved successful on pecan, Arizona ash, pepper tree [*Schinus molle*], beefwood [*Casuarina equisetifolia*], oleander, species of *Pyracantha*, *Cotoneaster*, and *Jasminum*, and Japanese and Californian privets [*Ligustrum japonicum* and *L. ovalifolium*]. In resistance tests some very good strains of Acala cotton showed definite resistance to root rot, but not enough to be of commercial value. The indicator plant (okra) [*Hibiscus esculentus*] revealed some areas of root rot in the Pima nursery.

A fungus causing a serious rhizome rot of iris plants was identified as *Fusarium solani* [ibid., xvi, p. 601] and the identification was confirmed by C. D. Sherbakoff. The rot attacks the secondary roots and stem bases and there is evidence that the fungus can enter through the uninjured epidermis.

Sclerotium rolfsii, first recorded on larkspur [*Delphinium*: ibid., xiv, p. 426] at Phoenix in 1936, was found during the season under survey attacking a small acreage of sugar beets [ibid., xvi, p. 227] between Tucson and Nogales, many miles distant.

Forty-seventh Annual Report for the fiscal year ended June 30, 1937.—*Bull. Wash. St. agric. Exp. Sta.* 354, 90 pp., 1937. [Received May, 1938.]

The section dealing with plant pathology in this report [*R.A.M.*,

xvi, p. 517] contains the following items of interest apart from those already noticed from other sources. F. D. Heald, C. S. Holton, and their collaborators in continued studies on wheat bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetens*]) [ibid., xvii, p. 164] found the 'short smut' race of *T. caries* for the first time in regions around Winchester, Craigmont, and Cottonwood, Idaho, about 75 miles from the Palouse wheat region. The chlamydospores of some races of *T. caries* and *T. foetens* germinated more readily at 18° C., others at 10°, while certain races germinated equally well at either temperature, the time required for germination at any given suitable temperature varying with the race. The chlamydospores of *T. caries* were generally larger than those of *T. foetens* and greater variation in spore size was shown by races of the former than of the latter [cf. ibid., xv, p. 287]. Hybrid spores of crosses between races T_3 and L_8 had some characteristics of each parent and were intermediate for others. Hussar × Hohenheimer, variety C.I. 10068–1, was highly resistant to all races used in testing wheats for bunt resistance. All the Turkey selections tested, except C.I. 11530, were highly resistant to all races except L_8.

F. D. Heald and R. Wellman state that the percentage of blue mould decay in apples [*Penicillium expansum*: ibid., xvi, pp. 189, 757] was correlated with the severity of washing treatment. Commercial tests showed that rinsing with 0·4 per cent. sodium hypochlorite may be expected to reduce markedly the blue mould decay. Experiments showed the feasibility of incorporating certain fungicides in waxes under laboratory conditions and the commercial adaptation of these results is now being attempted.

G. W. Fischer and his collaborators report considerable varietal resistance and susceptibility in some 50 collections of wheat grasses (*Agropyron* spp.) inoculated with *T. foetens* and *T. caries* [ibid., xvi, p. 90]. It is becoming evident that the mycelium is perennial in the infected perennial grasses; 87 per cent. of the crested wheat grass [*A. cristatum*] plants infected in 1935 showed bunted spikes in 1936 and of those surviving 61 per cent. were again infected in 1937. On the basis of comparative morphology the panicle smut (*Ustilago bromivora*) of brome grasses (*Bromus* spp.), the head smut (*U. lorentziana*) of barley grasses (*Hordeum* spp.), and the head smut (*U. bullata*) of *Agropyron* spp. are stated to represent one composite species evidently comprising numerous physiological races [ibid., xvii, p. 45]. The name *U. bullata* is suggested for this species, which represents the seedling type of infection and probably has a life-history similar to that of *U. avenae*.

Field observations and greenhouse tests with seedling potatoes carried out by L. K. Jones and his collaborators continued to show that of all tested varieties only Katahdin transmits to its progeny resistance to the veinbanding virus [ibid., xvi, p. 828]. In the field 28 out of 1,105 clones developed from selfed Katahdin plants remained free from infection for three consecutive years.

L. K. Jones and F. Johnson report that the viruses of enation and severe mosaic of peas [ibid., xvi, p. 651], after ageing *in vitro* beyond their formerly recognized activation period, may still produce infection in plants when the seed is soaked for 24 hours in either virus extract.

L. K. JONES states that the yellow and green mosaic viruses do not affect the growth of the Chief and Latham varieties of brambles [raspberries: ibid., xvi, p. 194] as severely as they do in the case of the Cuthbert variety; the latter has therefore been superseded by the former in the Spokane Valley area.

L. CAMPBELL, F. D. HEALD, and L. K. JONES find that black root and boron deficiency [ibid., xvii, p. 89] constitute two serious diseases of sugar beet in the Puget Sound sugar beet district of Washington. Some 35 different fungi were isolated from black root beets. This disease was found in all the examined fields, amounting to 95 per cent. in fields where beets had been grown for two or more years in succession. Symptoms of boron deficiency, ranging in extent from a trace to over 95 per cent. of the plants, were observed in 67 of about 90 fields examined.

L. K. JONES states that crinkle disease of geraniums [*Pelargonium*] was observed generally in the glasshouses of Washington; affected plants often show extreme dwarfing and crinkling of the foliage, which is chlorotic and develops necrotic spots. Preliminary field and glasshouse tests indicate that a virus may be the causal agent. Another disease of the same host, caused by a virus and named mosaic, was observed in a few greenhouses to produce a mottling of leaves with light and dark green areas often associated with extreme dwarfing of the plant.

BITANCOURT (A. A.). **Brazil: diseases of cultivated or useful plants, observed in the State of São Paulo.**—*Int. Bull. Pl. Prot.*, xii, 3, pp. 49–53, 1938.

This is the second part of the list of diseases of cultivated or useful plants studied at the phytopathological laboratory of the Institute of Biology, São Paulo, from 1931 to 1936 [cf. *R.A.M.*, xvii, p. 299].

ASUYAMA (H.). **New diseases and pathogenes reported recently on the cultivated plants in Japan. IV.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 231–236, 1938. [Japanese.]

Notes, with bibliographical references, are given on a number of new records of plant diseases and pathogens in Japan [cf. *R.A.M.*, xiv, p. 498], including *Ascochyta italica* on buckwheat, causing brown leaf spot, black rot of sweet potato (*Endoconidiophora* [*Ceratostomella*] *fimbriata*), a virus disease of the mulberry [see below, p. 538], rotting of *Brassica pekinensis* caused by a species of *Corticium*, *Ascochyta lycopersici* causing brown leaf spot of tomato, dry rot of gladiolus corms (*Sclerotinia gladioli*) [ibid., xv, p. 467], rose leaf spot (*Cercospora rosae*) [ibid., xvi, p. 462], carnation ring spot (*Didymellina dianthi*) [ibid., xvi, p. 751] and mosaic [ibid., xi, p. 797], sweet pea spot (*Ascochyta lathyri* var. *lathyri-odorati*) and anthracnose (*Glomerella rufo-maculans*) [*G. cingulata*: ibid., ix, p. 765], cyclamen anthracnose (*G. rufo-maculans* var. *cyclaminis*), and rust (*Uromyces achrous*) of blackwood (*Dalbergia sissoo*).

MALENÇON (G.) & DELÉCLUSE (R.). **Champignons pathogènes observés au Maroc.** [Pathogenic fungi observed in Morocco.]—*Bull. Soc. Sci. nat. Maroc*, xvii, 2, pp. 132–144, 1 pl., 1 fig., 1937.

This list of over 100 fungi parasitic on cultivated plants in Morocco

[cf. *R.A.M.*, xvii, p. 216] contains a number of new or interesting records, of which the following may be mentioned. *Phytophthora palmivora* was first observed on *Cocos campestris* in 1933. *Phoenix canariensis* leaves were found near Rabat in 1936, bearing *Graphiola phoenicis*, which also occurs on date palms [ibid., xii, p. 270] along the coast and on *Chamaerops humulis* near Rabat and Casablanca.

The perfect stage of *Corticium solani* was detected at Salé, in 1936, on native cultures of dwarf mint ([*Mentha*] *nana*), covering the lower surface of the stolons or the stem bases for distances of 20 to 30 cm. It has also been observed on *Gypsophila paniculata* at Casablanca.

Sclerotinia (?) *laxa* was found on apricots near Rabat in 1935.

Cercospora circumscissa on peach leaves [ibid., xvi, p. 492], *C. capsici* on chillies (*Capsicum annuum*) [ibid., xv, pp. 60, 136], *C. medicaginis* [*C. zebrina*] [ibid., ix, p. 319] on lucerne and *Trifolium spinosum*, and *C. resedae* on *Reseda odorata* were detected for the first time in Morocco between 1932 and 1936. Another new record [undated] for the country is *Heterosporium gracile* [? *Didymellina macrospora*] on iris [ibid., xvii, p. 112]. Newly reported species of *Alternaria* are *A. brassicae* (Berk.) Sacc. on cabbage [ibid., xvii, p. 284] and *A. citri* on citrons.

Oospora hyalinula was detected near Rabat in 1933 parasitizing *Fusicladium pirinum* [*Venturia pirina*] on pears. *Mauginiella scaettae*, the agent of a serious disease of date palms in Tunis [ibid., xvii, p. 314], was observed for the first time in south Morocco in 1933. *Entomosporium mespili* [*Fabraea maculata*] was first noticed on quinces [ibid., xvii, p. 188] near Rabat in 1934. Another new parasite of the same host is *Septogloeum cydoniae*, found causing an extensive black discoloration of the fruits and rendering them totally inedible at Port Lyautey.

Bacterium campestre [*Pseudomonas campestris*] was found in 1934 on *Matthiola annua*. *Bacillus carotovorus* [*Erwinia carotovora*] has been found once only, in 1936, on a native planting of carrots.

Bryan (C. S.). **Identification of Phytomonas, Azotobacter, and Rhizobium or Achromobacter upon initial isolation.**—*Soil Sci.*, xlv, 3, pp. 185–187, 1938.

At the Michigan Agricultural Experiment Station satisfactory differentiation of *Azotobacter* and *Rhizobium* from *Achromobacter* [*Bacterium*] *radiobacter* [*R.A.M.*, xvii, p. 209] and *Phytomonas* [*Bact.*] *tumefaciens* in soil isolations was afforded by the addition to Ashby's agar medium (*J. agric. Sci.*, ii, p. 35, 1907) of 20 c.c. of a 1 in 400 aqueous solution of Congo red (1 in 20,000 final dilution in the medium), under the action of which the subsurface colonies of *Bact. tumefaciens* are coloured red, those of *Azotobacter* pink, and those of *Rhizobium* and *Bact. radiobacter* white.

K. **Erfahrungen über die Bekämpfung des Wurzelkropfes in der Baumschule.** [Observations on the control of crown gall in the tree nursery.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 12, pp. 139–140, 1938.

Some years ago the writer inspected a block of two-year-old dwarf apples grafted on Paradise and Doucin stocks (types IX and V) which

showed nearly 100 per cent. crown gall [*Bacterium tumefaciens*]. The trees were quite unsaleable by reason of the pea- to walnut-sized excrescences caused by the pathogen, but complete recovery took place during the second year after the systematic excision of all diseased material and dipping the roots in a 1 per cent. uspulun-loam emulsion [*R.A.M.*, xiv, p. 499]. Paradise and Doucin slips disinfected in the same way remained free from infection, while those planted out without treatment were severely attacked.

RICEMAN (D. S.), DONALD (C. M.), & PIPER (C. S.). **Response to copper on a South Australian soil.**—*J. Aust. Inst. agric. Sci.*, iv, 1, p. 41, 1938.

Along the south-eastern coast of South Australia lie some hundreds of miles of blown calcareous sand containing over 60 per cent. of calcium carbonate in the surface soil and more below, and having a P_H value of 8·5 at the surface and 9·2 at depth. Natural pastures on this land consist almost wholly of inferior annual grasses, rye being the only cereal which can be grown successfully. Wheat, oats, and barley develop severe symptoms of a condition identical with the reclamation disease of north-eastern Europe [*R.A.M.*, xvii, p. 386]; the leaves droop, there is much withering, curling, and death of the tips, and if heading is reached grain is seldom formed. Copper sulphate applications resulted in normal vegetative development and greatly improved grain production.

A wide range of pasture species was sown, but few developed beyond seedling size. Copper sulphate applied at the rate of 28 lb. per acre did not generally prevent their failure, though it caused a slight response in some cases. Under pot culture conditions, however, an apparently normal development of subterranean clover [*Trifolium subterraneum*] was obtained by an equivalent application of copper sulphate.

The evidence indicated that other minor elements may be deficient or unavailable to the plants.

PICHLER (F.). **Berechnung der Aufwandmengen bei Trockenbeizen für verschiedene Sämereien.** [Calculation of the quantities of dust required for various kinds of seed.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 17–19, 1938. [English, French, and Spanish summaries on pp. 46, 50, and 54.]

Since the amount of dust required for the fungicidal treatment of different kinds of seeds varies for equal weights of seed according to the extent of surface exposed, the author determined the necessary quantities for certain cereal and vegetable seeds [cf. *R.A.M.*, xvii, pp. 332, 406] by comparison with wheat as follows. Wheat requires 200 gm. dust per 100 l. (78 kg.). In order to ascertain the corresponding amount for oats (100 l. = 47 kg.), the volumes for 1 kg. wheat and oats are estimated as 100 : 78 = 1·3 and 100 : 47 = 2·1, respectively, and if the amount of dust for 100 kg. wheat is 200 gm. then the requisite quantity for oats can be calculated from the proportion $1{\cdot}3 : 2{\cdot}1 = 200 : x$, whence $x = 323$; i.e., 100 kg. of oats will require 323 gm. dust. The amounts of dust calculated in a similar way to be necessary for the treatment of 100 kg. barley (four-rowed winter), winter spelt, sugar beet,

large-seeded maize, large peas, beans [*Phaseolus vulgaris*], Italian millet [*Setaria italica*], and French ray grass [*Arrenatherum avenaceum*] are 262, 354, 646, 200, 200, 185, 231, and 969 gm., respectively, the volume of 1 kg. of each being 1·7, 2·3, 4·2, 1·3, 1·3, 1·2, 1·5, and 6·5 l.

STOLZE (K. V.). **Die Lohnsaatbereitung in der Landesbauernschaft Weser-Ems.** [Co-operative seed treatment in the Weser-Ems agricultural district.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 1–11, 1 graph, 1 map, 1938. [English, French, and Spanish summaries on pp. 45, 48–49, and 53–54.]

Details are given of the present position in regard to the co-operative treatment of seed-grain in the Weser-Ems agricultural district of Germany [cf. *R.A.M.*, xvii, pp. 20, 100], where a further 67 complete seed-cleaning and -treating depots and 85 disinfection apparatuses are considered to be required in addition to the 447 depots (320 with and 127 without treating equipment) already in existence. At the moment 59 and 43 per cent. of the total amounts required of autumn and spring seed-grain, respectively, undergo fungicidal treatment in 75 per cent. of the Oldenburg depots. In the region under discussion the seed-treating depots are largely (58 per cent.) in the hands of millers; country tradesmen and co-operative societies each own 18 per cent., while the remaining 6 per cent. are variously occupied. Continuous dusting machinery is in operation at most of the depots, but latterly the short (liquid) disinfection process has begun to come into favour.

STAKMAN (E. C.), CHRISTENSEN (J. J.), & BECKER (HANNA). **Pathologische Probleme bei der Züchtung krankheitswiderstandsfähiger Weizen- und Gerstensorten im Sommerweizengebiet der Vereinigten Staaten von Amerika.** [Pathological problems in connexion with the breeding of disease-resistant Wheat and Barley varieties in the Summer Wheat area of the United States of America.]—*Züchter*, x, 3, pp. 59–68, 1 fig., 1938.

The writers summarize and discuss from a theoretical and practical standpoint some of the numerous problems confronting breeders of disease-resistant wheat and barley varieties in the summer wheat-growing area of the United States. Tables are given showing the reaction of 12 summer and 2 winter wheat varieties and 5 of *Triticum durum* to eight diseases, viz., black rust (*Puccinia graminis*), brown rust (*P. triticina*), bunt (*Tilletia* spp.), loose smut (*Ustilago tritici*), ear fusariosis (*Fusarium* spp.), foot rot (chiefly *F.* and *Helminthosporium* spp.), ergot (*Claviceps purpurea*), and black chaff (*Bacterium translucens* var. *undulosum*), and of 11 barley varieties to ten diseases, namely, black rust (*P. graminis*), dwarf rust (*P. anomala*), covered smut (*U. hordei*), false loose smut (*U. medians*) [*R.A.M.*, xvi, p. 737], loose smut (*U. nuda*), stripe disease (*H. gramineum*), ear fusariosis (*F.* spp.), kernel blight (miscellaneous fungi imperfecti and bacteria), helminthosporiosis (*H. sativum*), and mildew (*Erysiphe graminis*) [ibid., xvii, p. 384]. Nearly all the work on which the present survey is based has been noticed from time to time in this *Review*.

Future lines of approach to plant-breeding problems should include studies on the mode of inheritance of resistance, the ecological relations

of a given variety, physiologic specialization within the different pathogens, the influence of environmental factors on infection, the nature and probable limits of resistance, and inoculation experiments in breeding establishments on all hybrid populations with every known physiologic race of the various pathogens involved.

NIGGEMANN (W.). **Methoden zur Messung der Standfestigkeit und ihre Anwendung zur Bestimmung der Faktorenkopplung mit Gelbrostverhalten in verschiedenen Weizenkreuzungen.** [Methods for the measurement of resistance to lodging and their application to the determination of the linkage of factors with reaction to rust in various Wheat crosses.]—*Kühn-Arch.*, xliv, pp. 55–82, 7 figs., 1 diag., 6 graphs, 1938.

The main purpose of the work described in this paper was to establish, in the interest of wheat-breeding for resistance to yellow rust (*Puccinia glumarum*), the existence or otherwise of a linkage between factors for resistance in wheat to lodging and those for reaction to the rust. After briefly indicating the numerous abortive attempts to find a measure of resistance to lodging in the field and in the laboratory, the author states that the apparatus devised by Pech (*Z. Zücht.*, A, xxi, pp. 46–58, 1936) is open to several objections. To obviate these he constructed another apparatus, by which is measured the mechanical resistance to perpendicular pressure of wheat seedlings grown in quartz sand cultures; after having reached a height of about 7 cm., the seedlings are uniformly cut back to 6 cm., and, in groups of 20 seedlings, are subjected to perpendicular pressure exerted by a glass disk surmounted by an aluminium cup into which water is gradually poured from a graduated container; the weight in grams of the water necessary to bring about the collapse of the seedlings is taken as the measure of resistance to lodging, the glass disk and aluminium cup being counterpoised. Controlled tests with this apparatus [which is described in detail] showed that accurate results are obtainable with as few as 125 seeds.

In the investigation of linkage between the factors for resistance to lodging and for rust reaction the two wheat crosses Ridit × Peragis and Ridit × General von Stocken were used. The tests were made on a total of 29,394 plants of known rust reaction, of which 2,783 were studied from the standpoint of resistance to lodging. The results showed the possibility of combining factors for rust resistance with those for resistance to lodging, but the factors for the latter character could not be statistically analysed, though several appear to be involved. The resistance of Ridit to yellow rust in the field is apparently determined by two factors.

SĂVULESCU (T.). **Problém Pšeničných rzi v Rumunsky ve vztahu ke střední Evropé.** [The problem of Wheat rusts in Rumania in its relationship to central Europe.]—*Věstn. čsl. Akad. Zeměd.*, xiv, 4–5, pp. 329–341, 3 graphs, 2 maps, 1938. [German summary.]

The author prefaces this paper by pointing out that the economic losses caused in Rumania by the three main wheat rusts (*Puccinia*

triticina [*R.A.M.*, xvi, p. 19], *P. glumarum* [ibid., xiv, p. 214], and *P. graminis* [loc. cit.]) are much more considerable than is usually recognized, since even in very mild rust years the three diseases account for at least 5 per cent. of the total wheat crop, while in years of severe epidemics, such as for instance 1932, from 40 to 80 per cent. of the wheat may be destroyed by them. Of the three rusts, brown rust alone persists throughout the year on wheat in Rumania, either as uredospores on old stubble or as mycelium in autumn-sown or volunteer wheat plants, from which infection is renewed in the subsequent spring. Black rust infection is to some extent renewed in the spring from barberry bushes, which are still very numerous in the country, where their eradication is not compulsory. The principal sources of infection by all the three rusts, however, are the air-borne spores from the surrounding wheat-growing countries, and observations have established a direct relationship between the direction of the prevalent winds during the critical period for infection and the severity of rust outbreaks in different years.

The author believes that a measure of rust control may be attained by deep ploughing-in of wheat stubble immediately after harvest, followed by a fresh ploughing of the fields just before sowing time, to destroy volunteer wheat plants and weeds, as well as by sowing early maturing wheats; narrow-leaved varieties with relatively low water content are more resistant to the rusts than the broad-leaved and more succulent varieties, and should also be given preference; in his opinion, breeders should strive not so much for high yields as for earliness of maturity. Windbreaks in the field may also afford some protection against wind-borne inoculum.

VIELWERTH (V.). **Vývoj fysiologických forem mazlavé sněti hladké (Tilletia foetens) na středně nachylných Pšenicích.** [The development of physiologic forms of the smooth-spored bunt (*Tilletia foetens*) on moderately susceptible Wheats.]—*Ochr. Rost.*, xiv, 55, pp. 66–70, 1938. [German summary.]

A summarized account is given of experiments extending from 1935 to 1937, in which each of three Czechoslovakian awned wheats (Diosecka No. 2, Sekač No. 17, and Šuranska No. 121), moderately susceptible to bunt (*Tilletia foetens*), was inoculated each year consecutively with spores of the bunt originally collected from the variety under test and also with mixtures of spores from collections on other wheat varieties. The results showed a marked decline in pathogenicity of a given bunt collection when cultured on its own host repeatedly; whereas bunt collections from other wheat varieties, repeatedly grown on any of the three varieties mentioned above, showed increased pathogenicity, both results confirming those of previous work carried out during 1929 to 1934. The investigation is considered to have shown conclusively that the pathogenicity of bunt populations gradually decreases when they are constantly propagated on moderately susceptible wheat varieties, and that the latter play an important selective part in the development of physiologic races of the bunt, two facts which may find useful application in wheat breeding for bunt resistance.

Hiesch (P.). **Erfahrungen über gemeinschaftliche Steinbrandbekämpfung des Weizens bei den Siebenbürger Sachsen.** [Experiments in communal Wheat bunt control among the Transylvanian Saxons.] —*Nachr. SchädlBekämpf., Leverkusen*, xiii, 1, pp. 12–19, 3 figs., 1938. [English, French, and Spanish summaries on pp. 45–46, 49–50, and 53–54.]

Communal wheat seed-grain disinfection for the control of bunt [*Tilletia caries* and *T. foetens*: *R.A.M.*, xvii, p. 382] has been successfully introduced in Transylvania, Rumania. The treatment is carried out with ceresan dust in the Klein-Tillator apparatus [ibid., xiv, p. 519] and members of the Gross-Scheuern agricultural association pay in kind for the use of the fungicidal equipment and material. Three-quarters of the seed-grain required for the total wheat acreage in the district is treated.

Lasser (E.). **Der Einfluss von Licht und Jarowisation auf den Befall von Weizen, Hafer und Gerste durch Tilletia, Ustilago und Helminthosporium.** [The effect of light and vernalization on the infection of Wheat, Oats, and Barley by *Tilletia*, *Ustilago*, and *Helminthosporium*.]—*Kühn-Arch.*, xliv, pp. 161–210, 10 figs., 1938.

A fully tabulated account is given of field experiments, the results of which showed that vernalization of winter wheat grain before sowing in the spring did not increase its yield over that of untreated spring wheats, while vernalization of the seed of the latter produced a reduction in yield. Further tests showed that while vernalization did stimulate the growth of winter wheats and winter barleys, which could thus be induced to form ears in the greenhouse during winter, the process reduced the percentage infection of the seedlings with wheat bunt (*Tilletia tritici*) [*T. caries*] and barley loose smut (*Ustilago nuda*) in artificial infection tests to such an extent as to render them useless in breeding work for resistance to these two diseases.

It was further established that in the work of breeding barley varieties for resistance to *Helminthosporium gramineum* the data obtained from infection tests on barley plants grown in the greenhouse were not reliable, and that the stimulating action of light and temperature did not play an essential part in the infection of oats with loose smut (*U. avenae*), of wheat with bunt or loose smut (*U. tritici*), or of barley with loose smut.

Broadfoot (W. C.) & Tyner (L. E.). **Studies on foot and root rot of Wheat. V. The relation of phosphorus, potassium, nitrogen, and calcium nutrition to the foot- and root-rot disease of Wheat caused by Helminthosporium sativum P.K. & B.**—*Canad. J. Res.*, Sect. C., xvi, 3, pp. 125–134, 1 pl., 1 fig., 1938.

In further greenhouse studies in western Canada on foot and root rots of wheat [*R.A.M.*, xiii, p. 362], wheat seeds were grown in quartz sand with a complete nutrient solution and solutions containing different amounts of mineral elements, and were inoculated with a spore suspension of *Helminthosporium sativum* [ibid., xvi, p. 735], the spore suspension being replaced in the control series by an equal volume of

water. Disease damage was commonly interpreted according to the severity and extent of symptoms, but quantitative measurements of height and weight of the plants were equally satisfactory. Infection increased when the ionic concentration of potassium, nitrogen, and calcium was decreased below that of the complete nutrient solution, but no significant reduction of infection occurred when the concentration of all three elements and phosphorus was increased above that in the complete nutrient solution. Very small concentrations of phosphorus appeared to have no effect at all on the disease. The results show that potassium, nitrogen, and calcium are required in considerable amounts by wheat seedlings if they are to escape excessive damage from the pathogen, and though optimum concentrations for these ions exist, moderate increases above the optimum do not affect the reaction to the parasite. In field practice the same general principles may prove to apply.

When *H. sativum* was grown in pure culture in the same nutrient solutions (plus 2 per cent. dextrose solution) growth was seriously inhibited only in the non-nutrient solution and by the omission or excess of nitrogen, this being most marked with excess of nitrogen in the ammonium form. Of the four elements tested, nitrogen in the nitrate form would appear to be the most important for the growth of the fungus in normal soil.

FELLOWS (H.). **Interrelation of take-all lesions on the crowns, culms, and roots of Wheat plants.**—*Phytopathology*, xxviii, 3, pp. 191–195, 2 graphs, 1938.

The results of greenhouse observations at the Kansas Agricultural Experiment Station from 1928 to 1934, inclusive, on the interrelation of varying degrees of severity of the lesions on the roots, crowns, and culms of wheat plants infected by *Ophiobolus graminis* [*R.A.M.*, xvii, p. 103] are tabulated and discussed. A definite interrelation was established between the presence and severity of lesions on the organs under observation. If one organ alone was diseased, it was usually the root, invasion of which was rapidly followed by an attack on the crown. Increases in the percentage of crown infection were accompanied by (1) increases in root and culm infection, in the severity of the lesions on all parts, in the loss of roots, and in the percentage of dead plants; and (2) decreases in the average height of plants and in the percentages of culms heading and plants tillering. All the plants killed by the fungus and those on which sporulation was observed (29·7 per cent. of the latter were dead) showed infection of the roots, crowns, and culms.

SPRAGUE (R.). **Influence of climatological factors in the development of Cercosporella foot rot of Winter Wheat.**—*Circ. U.S. Dep. Agric.* 451, 40 pp., 2 diags., 13 graphs, 2 maps, 1937.

Foot rot of wheat, caused by *Cercosporella herpotrichoides* [*R.A.M.*, xvii, p. 166], is stated to occur in prairie sections of the Pacific North-West of the United States, where the annual rainfall is 14 to 25 in., and in portions of the Columbia River Basin, where the mean temperature for the growing season is usually between 40° and 45° F. Studies in both field and greenhouse showed that the fungus

throve best in soils with abundant water content, but not near the saturation point. The disease increased with a rise in the relative water content of the soil surface, and it is stated that drying winds have often prevented serious damage. The optimum temperature for the growth of the fungus in the host is about 10° C., but it was able to grow at 6°, while growth was distinctly retarded at 15°. In pure culture the optimum, minimum, and maximum temperatures for vegetative growth were 20 to 21°, 4°, and 30°, respectively. Freezing temperatures were indirectly favourable to the disease by injuring the weaker, smaller culms; light had no noticeable effect on the action of the fungus. Heavy rainfall in spring and early summer helped to bring about destructive attacks of the disease.

TOOMRE (R.). **Odra ja Nisu lendnõgipeade tõrje.** [The control of Barley and Wheat loose smuts.]—*Agronoomia*, xviii, 5, pp. 357–394, 11 figs., 1 diag., 4 graphs, 1938. [Estonian, with English summary.]

The loose smuts of barley (*Ustilago nuda*) and wheat (*U. tritici*) are stated to be widespread in Estonia, where the average incidence of 2 per cent. may rise in individual cases to over 20 per cent. Very good control of the disease has been obtained by the hot-water treatment, using a special sprinkling apparatus [which is fully described and figured] involving preliminary immersion of the seed-grain for four hours in water heated to 25° C. followed by ten minutes' steeping at 52°. Under proper working conditions the reduction of germination by this method of treatment should not exceed 3 per cent. In order to dry the seed-grain sufficiently for storage it should be exposed for 1½ hours to a temperature of 30°, rising during the next 1½ hours to 50°. For immediate sowing the seed-grain should be dried for 24 hours at 15° to 20°.

NATTRASS (R. M.). **Diseases of cereals. IV.**—*Cyprus agric. J.*, xxxiii, 1, pp. 8–10, 2 figs., 1938.

Barley net blotch (*Helminthosporium teres*) [*R.A.M.*, xvi, pp. 20, 443] is one of the most prevalent cereal diseases in Cyprus, usually occurring in conjunction with covered smut [*Ustilago hordei*] and leaf stripe (*H. gramineum*). It appears in winter and early spring on nearly all barley crops, becoming noticeable when the plants are 4 to 10 in. high. Seed-dusting with some substance, such as agrosan or ceresan, which will control all three diseases is recommended, as none is at present important enough to require specific control.

ISENBECK (K.). **Die Bedeutung der Faktoren Temperatur und Licht für die Frage der Resistenzverschiebung bei verschiedenen Sommergersten gegenüber Helminthosporium gramineum. Ein Beitrag zum Anlage-Umwelt-Problem.** [The importance of the factors temperature and light in connexion with the question of the variation of resistance in various spring Barleys to *Helminthosporium gramineum*. A contribution to the constitutional predisposition—environment problem.]—*Kühn-Arch.*, xliv, pp. 1–54, 1 diag., 2 graphs, 1938.

This is a detailed and fully tabulated account of the author's con-

tinued studies on *Helminthosporium gramineum* on barley in Germany [*R.A.M.*, x, p. 231], with particular reference to the effect of temperature and light on the resistance of barley plants to the stripe disease and on the development of the pathogen in the infected plants. Material for artificial inoculations (made by germinating unhulled barley seeds in Erlenmeyer flasks under cultures of the fungus on sterilized wheat grains) was collected in 1933 from all over Germany, where in that year the most widely sown spring barleys, e.g., Eglfinger Hado, Streng's Franken, Müller's Franken, Isaria, and Bavaria, were reported to have been fairly severely attacked by the disease, and to be in general more susceptible to it than winter barleys. Single-spore isolations from this material showed a very considerable variation in the type of growth and colour of the colonies obtained, and these two characters were not reliable for determining the origin of the strain studied. Of 451 pure lines of *H. gramineum* thus developed, 23 were selected as the most representative for Germany, and were used in further work, together with two strains received from Minnesota. The results of preliminary pathogenicity tests gave a clear indication that these 25 pure lines may be divided into six race groups differing in their reaction on five spring barley varieties (Heine's Hanna, Heine's 4-rowed, Jassener Landgerste, Cape × Coast 1518, and Morgenrot, a Heil's Franken × Australian Early hybrid) which were used as differential hosts.

The action of temperature and light was tested separately under controlled conditions on the host plants both free from and infected with the pure lines of the pathogen, and on the various pure lines themselves in pure culture on 2 per cent. potato dextrose agar. The results of the temperature series are considered to indicate that with certain barley varieties, at least, the relative rate of growth may be either increased or reduced by fluctuations of temperature. In a special series of experiments it was shown that the optimum temperature for infection by certain pure *H. gramineum* lines varies from one host variety to another; thus, for instance, the optimum temperature for infection by line 3501–11 was 10° C. on Heine's Hanna, Velvet, Heine's 4-rowed, and Nacktgerste, and 5° on Cape × Coast and Morgenrot. The optimum for line 68–1 was 10° on three varieties and 15° on three others. The lines also varied in the rate at which they lost their infective power at higher temperatures: line 118–2 caused 82·7 per cent. infection on Heine's 4-rowed at 5°, and only 5·4 per cent. at 25°; on the same variety line 3501–11 caused 59·6 per cent. infection at the lower and 4·2 per cent. at the higher temperature, while line 68–1 was able to cause heavy infection on highly susceptible varieties, such as Velvet and Nacktgerste, even at the higher temperatures. These results are held to show that while, generally speaking, lower temperatures tend to lower the resistance of the host to the fungus, this effect is largely dependent on the temperature requirements of the *H. gramineum* strain concerned. The results of three series of experiments indicated that exposure of plants already infected to higher temperatures tended to increase the development of the disease, but here again variations in the reaction to temperature were found to be conditioned by the biotypical peculiarities of host and parasite strains.

The results of extensive experiments on the influence of light on the

host plants and on the pathogens showed that, while in general additional lighting stimulated the growth of the former, its effect varied considerably with the different varieties; none of the fungus strains, on the other hand, appeared to be much affected by this factor. The light optimum for maximum infection of a given variety largely depends on its response to certain intensities of light. When natural daylight was insufficient, additional lighting stimulated infection and development of the disease, but only up to a certain limit of total light intensity, beyond which it increased the resistance of the host, especially in rapidly growing barley varieties, such as Morgenrot. Host susceptibility, however, was much less affected by light than by temperature.

THREN (R.). **Kritische Versuche zur Resistenzprüfung der Gerste gegen Flugbrand (Ustilago nuda (Jens.) Kellerm. et Sw.).** [Critical examination of the methods for testing Barleys for resistance to loose smut (*Ustilago nuda* (Jens.) Kellerm. & Sw.).]—*Kühn-Arch.*, xliv, pp. 211–231, 2 figs., 1938.

The results of the experiments described in this paper showed that the frequently considerable losses of infected material in studies on the breeding of barley for resistance to loose smut (*Ustilago nuda*) (involving artificial infection of the barley flowers with the fungus, and more especially by means of the apparatus described by Piekenbrock [*R.A.M.*, vii, p. 435]) are mainly due to the excessive numbers of spores which are introduced into the flowers. Such losses may be to a very great extent minimized by 'diluting' the inoculum (i.e., by using smut spores killed either with ether or by exposure for several hours to dry heat at 150° C., to which from 1 to 5 per cent. of fully viable spores are added), without materially affecting the percentage of infection of the flowers inoculated.

Further experiments showed that the percentages of infection determined in barley smut-resistance tests are for the most part misleading. For practical purposes it is quite sufficient to group the varieties or lines of barley tested into five different classes of susceptibility (from 0 to 4), as used in breeding work for resistance to rusts, with appropriate notation for the intermediate classes. Some further directions are given which are of practical value to barley breeders.

SÉLARIES (P.). **Observations sur le charbon nu de l'Orge.** [Observations on loose smut of Barley.]—*C.R. Acad. Agric. Fr.*, xxiii, 23, pp. 747–751, 1937.

Since 1931 a disquieting increase in the incidence of loose smut of barley (*Ustilago nuda*) is stated to have been observed in Alsace (France), strain 179 being more susceptible to the disease than 142. In a test in which seed-grain of strain 142 was subjected to the standard hot-water treatment (ten minutes immersion at 52° C.) (*a*) on 8th October, 1932, and (*b*) on 8th March, 1933, the percentage of germination in the former lot was 23 at a temperature of 20°, and in the latter 99 and 98 at 20° and 13°, respectively. Rapid drying in the open air after treatment was found greatly to increase germinability (from 23 and 41 to 98 and 98 per cent., respectively, at 20° and 13°). The

temperature of the bath should not be allowed to exceed 52·5°, and a period of ten minutes is ample for the destruction of the fungus; by doubling the duration of treatment, germination was reduced from 98 to 46 per cent. Although no loss of germinability resulted from this method of control in laboratory tests, a 7 to 10 per cent. diminution was observed in the field, even where the operation was carried out with scrupulous care, while up to a week's delay in emergence has also been recorded. The absolute elimination of the smut by the hot-water bath is of particular value in the case of selected stocks destined for reproduction.

Neill (J. C.). **Trials of agrosan and ceresan.**—*N.Z. J. Agric.*, lvi, 3, pp. 162–163, 2 figs., 1938.

In these experiments seed of Jumbuck, Major, and Solid Shaw Tuscan Wheats, S.A. Chevalier, N.Z. Chevalier, and Cape barleys, Garton's Abundance, Dun, and Algerian oats, and Marrowfat peas was dusted with agrosan G improved and ceresan (1875 A) at the rate of 2 oz. per bush., and sown immediately after treatment and after storage of the dusted seed for periods up to five months. The following results were obtained: wheat stinking smut [bunt: *Tilletia caries* and *T. foetens*], barley covered smut [*Ustilago hordei*] and stripe [*Helminthosporium gramineum*], and loose and covered smuts of oats [*U. avenae* and *U. kolleri*] were completely eliminated by both the dusts whereas untreated seed of the above-mentioned varieties of wheat gave 8·4, 1·3, and 3·9 per cent. bunt, respectively, untreated seed of the three barley varieties 6·2, 3·8, and 0·9 per cent. covered smut and 0·6, 0, and 7·1 per cent. stripe, and controls of the three oat varieties 6·8, 11·2, and 3·7 per cent. smut. A further test with a heavily smutted line of Garton's Abundance oats that gave 18·3 per cent. infection from untreated seed showed only 0·8 and 0·5 per cent. smut in the plants from dusted seed. With the peas germination was improved by 12 to 14 per cent. by both dusts. All the dusted seed showed higher germination in the field than the undusted, though there was no difference in the laboratory.

Ivanoff (S. S.), Riker (A. J.), & Dettwiler (H. A.). **Studies on cultural characteristics, physiology and pathogenicity of strain types of Phytomonas stewarti.**—*J. Bact.*, xxxv, 3, pp. 235–253, 1 fig., 1 graph, 1938.

A number of single-cell cultures of *Phytomonas* [*Aplanobacter*] *stewarti*, the agent of striping and wilting of maize and other grasses in the United States [*R.A.M.*, xvii, p. 388], has been studied in respect of various morphological and physiological characters, including pathogenicity.

The conspicuous differences between the cultures after a fortnight's growth on nutrient glucose agar plates at 24° C. permitted their classification in three types. 'A' produced orange-yellow, predominantly smooth, convex colonies of a butyrous consistency, 10 to 12 mm. in diameter, making profuse growth in Ivanoff's selective liquid medium, and inducing in nutrient glucose broth an acid reaction after a week and an alkaline one after four weeks. The cultures of this type were fairly stable and proved highly pathogenic in inoculation experiments

from 1933 to 1935, inclusive, especially on the Golden Gem and Golden Bantam varieties, Country Gentleman being relatively resistant. The colonies of 'B' were lemon-yellow, viscid, sometimes containing an abundance of gum, smooth, raised, about 8 to 10 mm. in diameter, making variable growth in Ivanoff's medium, and inducing an acid reaction in nutrient glucose broth after both one and four weeks' growth. Variable pathogenicity was another feature of this type, the characteristics of which were also liable to change into those of 'C' after prolonged cultivation on artificial media. Type 'C' formed cream-yellow, membranous, smooth, flat colonies, 3 to 5 mm. in diameter, growing well in the selective medium and inducing an acid reaction in nutrient glucose broth after one and four weeks' growth. The pathogenicity of this type was slight and its characteristics stable.

None of the cultures of any type liquefied gelatine, appreciably changed the colour of litmus milk, produced indol, or hydrolysed starch. All induced an acid reaction after a week's growth with glucose, sucrose, levulose, galactose, lactose, glycerol, and mannitol, and no change or an alkaline reaction with maltose, starch, inulin, dextrin, salicin, pectin, and basic media without added source of carbon. Only slight differences in the amount of glucose utilized by the various cultures were observed after three weeks' growth in nutrient broth.

Records of the type of *A. stewarti* cultures found in various localities from 1932 to 1936, inclusive, showed that A was originally isolated only from Eastern-grown material, but later developed sparingly in Middle Western plants, while C was rare and occurred solely in districts where B was prevalent.

A direct relationship was established between the abundance of gum production by certain cultures and their pathogenicity to maize.

No alteration in the taxonomic status of *A. stewarti* is suggested on the basis of these cultural differences.

Spencer (E. L.) & McNew (G. L.). **The influence of mineral nutrition on the reaction of Sweet-Corn seedlings to Phytomonas stewarti.**— *Phytopathology*, xxviii, 3, pp. 213–223, 3 figs., 1938.

The influence of nitrogen, phosphorus, and potassium nutrition on the reaction of Golden Bantam maize seedlings to *Phytomonas* [*Aplanobacter*] *stewarti* [see preceding abstract] was studied at the Rockefeller Institute for Medical Research, Princeton, New Jersey, notes on the degree of infection being made ten days after inoculation.

Seedlings stunted by high concentrations of the three elements were more severely attacked than those receiving the moderate quantities conducive to rapid growth. A deficiency of potassium was more serious from the standpoint of bacterial wilt infection than a shortage of either nitrogen or phosphorus. Nitrogen deficiency resulted in the development of small necrotic lesions but little or no foliar wilting, whereas an excess of nitrogen gave rise to intense infection, involving the death of about half the seedlings within a fortnight of inoculation. At high phosphorus levels the attacks of *A. stewarti* were characterized, not only by the formation of necrotic lesions (which also developed where this element was deficient), but by dwarfing of the seedlings and general foliar wilting. Either a decline or a rise in the potassium con-

centration, respectively, below or above 40 mg. per 100 c.c. favoured wilting which was severe in seedlings without potassium and increased as the potassium concentration was raised from 40 to 200 mg. per 100 c.c.

It is apparent from these data that mineral nutrition exerts a certain influence, the exact scope of which remains to be determined, on the host-pathogen complex of bacterial wilt of maize.

KOEHLER (B.). **Fungus growth in shelled Corn as affected by moisture.** —*J. agric. Res.*, lvi, 4, pp. 291–307, 3 figs., 1 diag., 1 graph, 1938.

The effect of moisture on the growth of various fungi in maize grain was studied in experiments with unsterilized, uninoculated grains and in pure culture work with surface-sterilized material. Shelled yellow dent maize was placed in wire baskets over solutions of appropriate salts in closed glass bottles and thus stored at constant humidities for 3 months at 70° F. The moisture content of grain stored at a known constant humidity was found to vary in different strains of maize or even possibly in individual kernels. *Aspergillus* spp. [*R.A.M.*, xiv, p. 232] grew at lower degrees of water content than other fungi, *A. glaucus* appearing at 14·3 per cent. water content, *A. versicolor* at 15 per cent., *A. wentii* at 15·4 per cent., *A. ochraceus* at 15·6 per cent., and *A. flavus* and *A. niger* [ibid., xiii, p. 572] at 18·3 per cent. Of the *Penicillium* spp. [loc. cit.] causing the 'blue-eye' condition of grain *P. notatum* [ibid., xvi, p. 558] appeared at 16·7 per cent. and *P. palitans* [ibid., xiii, p. 233] at 19·5 per cent. water content; an increase in moisture intensified the development in each case. *Fusarium moniliforme* [*Gibberella moniliformis*: ibid., xvi, p. 806] grew at minimum water contents varying between 18·4 and 21·2 per cent., demonstrating the variability of the different strains of this fungus. At over 23 per cent. this fungus often predominated over all others except when *Diplodia zeae* [ibid., xvii, p. 238] was present; the latter appeared first at 21·2 per cent., but at over 23 per cent. was predominant over all the other fungi. *Gibberella zeae* grew at 22·2 per cent. and competed vigorously with other fungi at 26 per cent. *Nigrospora sphaerica* [ibid., x, p. 644] grew at 22·5 per cent. but was a poor competitor. *Cephalosporium acremonium* [ibid., xvi, p. 168] was not observed on unsterilized grain, but grew at 23·4 to 27 per cent. under pure culture conditions. Fungous growth resulted in commercial damage to the grain when the water content was about $1\frac{1}{2}$ to 2 per cent. higher than the lowest moisture limit for growth.

Head smut in Maize.—*N.Z. J. Agric.*, lvi, 3, p. 184, 1 fig., 1938.

Samples of maize from the vicinity of Gisborne, New Zealand, were found to be infected by head smut [*Sorosporium reilianum*: *R.A.M.*, xvii, p. 347], which seems to have been present in the district for some years, and to be fairly widespread. A thorough survey of the position is being made.

BRYAN (O. C.). **Deficiency symptom patterns in Citrus.**—Reprinted from *Citrus Ind.*, *1938* (March), 5 pp., 2 figs., 1938.

The author gives summarized notes on the symptomatic patterns produced on the leaves of oranges, grapefruit, and tangerines by deficiency of nitrogen, phosphorus, potassium, calcium, magnesium, iron,

copper, zinc, manganese, and boron. These patterns are illustrated, and their use in practice explained. The paper concludes with some general recommendations on treatment, and there is a bibliography of 15 titles.

PARK (M.). **Citrus canker and its control.**—*Trop. Agriculturist*, xc, 3, pp. 127–135, 1 pl., 1938.

In this account of citrus canker (*Pseudomonas citri*) and its control in Ceylon, already noticed in part from another source [*R.A.M.*, xvii, p. 294], the author states that the disease occurs in most parts of the island, mainly at elevations below 3,000 ft., attacking most severely grapefruit and lime, whereas the mandarin orange and sweet oranges of the Jaffa and the Valencia type and especially lemons are stated to be highly resistant. An eradication campaign on the same lines as in the United States and in South Africa, apart from being costly, would be extremely difficult to carry out in Ceylon, as the disease occurs on many isolated trees in home gardens and on wild species of citrus in the jungle. Many districts in the dry zone are fairly free from infection and they are recommended for the planting of new orchards, for which disease-free stocks or seed should be used. Infected trees within ¼ mile of any site on which it is proposed to plant should be burnt; furthermore a careful watch should be maintained against accidental infection by visitors, and when such an infection is discovered the diseased tree should be burned immediately. In already existing orchards the planting of windbreaks, e.g., *Gliricidia*, in every other row at right angles to the prevailing wind is advised for both young and old trees. Thorough picking and burning of diseased leaves at intervals of about two weeks, followed by spraying with colloidal sulphur or lime-sulphur in combination with an insecticide (nicotine sulphate at the rate of ⅛ to ¼ oz. per gal.) effective against the common leaf mining caterpillar (*Phyllocnistis citrella*), which is associated with the citrus canker in a not yet clearly defined way [loc. cit.], is stated to reduce the disease to a very low level in young trees. In old trees the treatment varies with the climate. Picking and burning of diseased leaves and shoots towards the end of the dry season and repeated spraying of young foliage is only recommended in the dry zone; in the wet zone, where there is no marked resting season or period of new growth, the cost of an all-round-the-year treatment would be too prohibitive. Small-scale experiments indicated that the bagging of fruits, just after they have set, in ordinary grease-proof bags protected them to a great extent against infection, and at a later stage against fruit fly attack. It is stressed that regular manuring and a high standard of cultivation should be maintained, when the disease is severe, to make up for the loss of plant tissue through defoliation. Wherever it is possible, and especially in young trees, removal of infected susceptible trees and their replacement with resistant varieties is advocated.

RUGGIERI (G.). **Indagini sulla varietà di Limone 'Monachello'.** [Researches on the 'Monachello' Lemon variety.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 3, pp. 293–304, 7 figs., 1937. [Received May, 1938.]

A survey of the lemon groves in the vicinity of Messina, where 'mal

secco' disease (*Deuterophoma tracheiphila*) [*R.A.M.*, xvi, p. 743] has been present for many years, showed that practically all the fully grown Monachello trees (of which about 40 were found) were in a very good vegetative condition though other varieties in their immediate proximity had either disappeared or had become severely affected. In one locality (much neglected and exposed to the wind), however, the Monachello trees were appreciably diseased. Very young Monachello and Interdonato trees were more commonly affected than the older ones, though the disease appeared to progress very slowly and was not fatal. Taken as a whole, the observations indicated that the Monachello lemon is very highly resistant to 'mal secco' though not immune from it. Infection on this variety appears to progress so slowly that control should be easy and inexpensive.

MATSUMOTO (T.) & HUZIOKA (Y.). **Bacteriophage in relation to Bacterium malvacearum E.F.S. I. Preliminary study.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 193–202, 2 figs., 1938. [Japanese summary.]

The bacteriophage of *Bacterium malvacearum* [*R.A.M.*, xiv, p. 757] was obtained from an aqueous suspension of crushed, diseased cotton leaves kept at 10° C. for three weeks. The potency of the lytic principle was determined by the dilution method and plaque formation on potato dextrose agar. The former demonstrated that the filtrate of three passages gave a titre of 10^{-7}, while the latter showed that a loop of the 1/100 diluted filtrate (seventh passage) produced four plaques, the same quantity of 1/10 filtrate giving 109. Three drops of the latter appeared to be the limit for the accurate counting of the plaques, of which 1,950 were produced.

The highest lytic activity occurred near 28° or between 25° and 28°; it very probably parallels approximately the maximum growth of the homologous bacteria. Probably 37° is near the maximum temperature, while the minimum may be under 10°.

All four strains isolated from the phagic cultures were extremely resistant to lytic action. The pathogenicity of these strains did not differ appreciably, however, from that of the original, as shown by inoculations of detached cotton bolls.

The size of the plaques on the potato dextrose agar varied inversely with the agar concentration, and they grew larger to some extent with an increase in the incubation period.

ANDREWS (F. W.) & CLOUSTON (T. W.). **Section of Botany and Plant Pathology.**—*Rep. Dep. Agric. For. Sudan Govt, 1936*, Part II, pp. 26–35, [? 1938].

In this report on plant disease work in the Anglo-Egyptian Sudan in 1935–6 [cf. *R.A.M.*, xvi, p. 173] it is stated that blackarm [*Bacterium malvacearum*: ibid., xvii, p. 455] was first reported in the Gezira on new cotton on 1st September, but with some notable exceptions the disease did not cause serious damage. At the Gezira research farm, all the cotton debris was swept up by hand in May, June, and July, collected into heaps, and burnt, after which the plots were heavily flooded, all parts being submerged, and kept under constant observa-

tion; any seedlings that appeared were at once removed. As a result of these measures the ensuing attack of blackarm was one of the lightest recorded. The earliest outbreaks in areas not previously sown with cotton were sporadic, the main infection apparently having arisen from scattered debris and seed cotton, brought in by the natives. An experiment was made to determine whether infected volunteer cotton seedlings or infected cotton debris on old cotton land was the chief source of infection of a new crop. A series of small plots was treated as follows: (*a*) ground spread with infected cotton debris alone, (*b*) the same, the debris being afterwards swept off, (*c*) ground spread with infected debris and flooded for one day with water containing 1 lb. of chloride of lime, (*d*) as the preceding, but flooded for three days, and (*e*) a few widely scattered cotton seedlings were grown in the plot and infected with blackarm by spraying. Parallel to these plots and 10 m. from them, other plots were sown with healthy cotton, so that the prevailing winds and rains blew from the treated plots to the healthy cotton. After a rainstorm, a count showed very conclusively that infection of the new crop was due principally to the artificially infected seedlings, the average percentages of infection in the plots (*a*) to (*e*) being 0·67, 0·32, 1·22, 0·46, and 23·4 per cent. respectively. A striking feature of the experiment was the efficiency of the durra (*Sorghum* spp.) hedges between the treatment plots in preventing the carry-over of the disease from a severely infected plot to an adjacent lightly infected one, in spite of the very poor growth made by much of the durra.

Leaf curl [loc. cit.] in the Gezira area was of negligible importance, except in very localized areas. One-third of the area was sown with the resistant X 1530 cotton, and the continued use of resistant varieties is expected to eliminate the disease shortly.

Wilt [loc. cit.] was not serious in the Gezira. In the past the condition has been attributed to loss of the fine roots, but though wilted plants do possess a poor 'fine root system', it now appears that the primary cause is the rotting of laterals in the subsoil from their distal ends. Fungal attack on the roots was much heavier than in the previous season, 778 fungal isolations being made from 1206 samples of fine roots, including 361 of culture 'XT' type, not yet identified [ibid., xvi, p. 174], 133 of *Pythium* spp., including *P. butleri*, *P. periplocum* [ibid., x, p. 211], *P. afertile*, types near *P. de Baryanum*, and other fungi; from 128 samples of rotted secondarily thickened roots 146 isolations were made, including 85 of the L 47 type (*Rhizoctonia*) and 41 of the 'XT' type.

In experiments on the effect of soil conditions on root and shoot development some improvement was effected by digging the soil 3 ft. deep, firing the top 6 in., mixing this with the next 6 in., and replacing. Puddling the surface of the soil between the ridges after irrigation slightly increased yield. The differences in early growth between plots following salt bush [*Atriplex*] and those following a year's fallow was strikingly in favour of the former. The salt bush markedly reduced the resistance of the soil to mechanical penetration. The evidence obtained indicated that the subsoil in 'wilty' patches was more resistant to penetration than that in wilt-free areas.

As regards numbers of rootlets and extent of discoloration, the X 1530

and 898 cotton varieties were found to be superior to Main Crop Sakel; X 04729 and Multani were about equal to Main Crop, and XH 1229 and Nahdah were inferior.

Records of the incidence of wilt and recovery from it indicated that (1) local soil variations are presumably more important in their effect on the incidence and distribution of wilt than any experimental treatment (sowing date, spacing, manuring, rotation, and the like) on which wilt counts were made; (2) the inclusion of leguminous crops in the rotation and manuring with nitrogenous manures appeared to increase wilt; (3) light, rather than heavy, watering tended to increase wilt; and (4) varietal differences in susceptibility exist.

The final yields of seed cotton given by sets of 50 plants which (*a*) wilted early in November and recovered by the end of the month, (*b*) wilted early in December and recovered by the end of the month, and (*c*) had not wilted by the end of December (controls) were 867, 837, and 1,163 gm., respectively. The produce of the wilted plants was inferior to that of the controls in regularity and toughness of lint, and in lint index and seed weight.

Laboratory inoculations of cotton seedlings with all the chief fungi isolated from cotton roots during the season gave infection of the fine roots by all the fungi tested except L 47, which, however, produced severe rotting of the lower portion of the tap-root in seedlings grown in soil or sand and watered with soil extracts. The growth rate of the seedlings appeared to be unaffected by the root infections, but the leaves of seedlings infected with *Pythium* spp. and *Fusarium* spp. were yellowed. Experimental evidence was obtained that aeration of the soil produced no obvious differences in the amount of root-rotting.

Leaf spot of *Dolichos lablab* caused by *Bacterium phaseoli* [ibid., xiii, p. 565] was generally distributed throughout the early sown crop in the Gezira, but caused no serious damage, the attack being chiefly confined to the lower leaves. At the Gezira research farm all types of *D. lablab* were affected, but only on the plots sown earliest was any appreciable damage done. *Mucuna* spp. and *Desmodium* spp. were not attacked. The pathogenicity of the organism was confirmed by needle inoculations of healthy *D. lablab* plants and spraying with an aqueous suspension of the bacterium. When soil containing leaf and stem debris was flooded for two days the organism was completely eliminated. Transmission of the disease through the seed, probably internally, was indicated by successful inoculations with a decoction obtained by surface-sterilizing and crushing seeds taken from infected pods.

WATKINS (G. M.). **Histology of Phymatotrichum root rot of field-grown Cotton.**—*Phytopathology*, xxviii, 3, pp. 195–202, 1 fig., 1938.

In cases of spontaneous infection of cotton roots in central Texas by *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 456], the fungus forms hyphal wefts that grow over the surface of the periderm and often accumulate in the superficial crevices resulting from the rupture and sloughing-off of the outer cork layers. The peridermal cell walls in immediate proximity to the hyphal aggregations soon begin to show modifications in structure, colour, and thickness, presumably due to the chemical action of fungal secretions. These walls also develop

breaks through which the root rot organism can invade the newly opened cell cavity. The centre of the lesion formed by *P. omnivorum* in its gradual progress through the periderm is occupied by a compact hyphal mass containing in its interior the engulfed remnants of partially disintegrated cork walls. After penetrating the phellem, the mycelium rapidly traverses the phelloderm, phellogen, phloem, and cambium, causing extensive cellular collapse, and enters the xylem, where its passage from cell to cell is effected chiefly by way of the pits, the lignified walls being resistant to fungal invasion.

NEILL (J. C.) & TRAVERS (E.). **Prevention of deterioration of tent calico.**—*N.Z. J. Sci. Tech.*, xix, 10, pp. 646–651, 3 figs., 1938.

Experiments on the treatment of tent calico for the prevention of mould deterioration in New Zealand showed that complete protection is afforded by the iron-chromium process, in which the fabric is passed through two baths, the first containing 10 per cent. iron alum and 10 per cent. chromic sulphate (or 20 per cent. chrome-alum), and the second 10 per cent. potassium chromate. The disadvantages of this method are its expense, its inapplicability after making up, and its tendency to discolour the material. Hoyle's proprietary dressing gave a measure of control but permitted the development of small mould colonies imparting a stippled aspect to the calico, while aluminium acetate actually accelerated the disintegration of the fabric. Good control, on the other hand, was obtained by one hour's immersion of the calico in a 1 per cent. aqueous solution of shirlan WS [cf. *R.A.M.*, xvii, p. 212], followed by 24 hours' atmospheric drying. For practical purposes it is recommended that the tent (with ropes) should be immersed in a solution consisting of 1½ oz. shirlan per gal. water; for a single full-sized tent and fly about 10 gals. solution are required, using approximately 1 lb. shirlan, the present cost of which is 9*s.* 6*d.*

The fungi isolated from discoloured calico include species of *Cladosporium*, *Stemphylium*, *Alternaria*, *Pullularia*, *Pleospora*, *Phoma*, *Aspergillus*, *Penicillium*, *Acladium*, *Cephalosporium*, *Rhizopus*, *Mucor*, and *Torula*. Of these, *Cladosporium herbarum* is much the most important, having been uniformly isolated from the brownish-black areas on samples received from all localities, and most readily causing deterioration of the fabric. In marked contrast is the brown, somewhat diffuse spotting caused by *Stemphyllium* and *Alternaria* spp. *Pullularia pullulans* produces a spreading dark stain rather than a spot. *Pleospora* and *Phoma* spp. were usually isolated from material in an advanced stage of deterioration and could only be cultured with difficulty on sterile calico. In nature they produce light brown areas showing concentric rings of black pin-head dots. The other organisms concerned only grow in a saturated atmosphere, and (with the possible exception of *Torula*) do not stain or darken the fabric.

THARP (W. H.). **A sand-nutrient infection technique for the study of Fusarium wilt of Cotton.**—*Phytopathology*, xxviii, 3, pp. 206–209, 1 fig., 1 diag., 1938.

Full particulars are given of the so-called sand-nutrient infection technique for the determination of the varietal resistance of cotton to

wilt (*Fusarium vasinfectum*) [*R.A.M.*, xvii, p. 35] at the Arkansas Agricultural Experiment Station. Twenty-four 3-gal. earthenware jars, with centre drainage holes in the bottom, were equipped with siphon drains for the removal of superfluous moisture and filled to within 2 in. of the top with washed river sand pasteurized at 80° C. Three days before planting the cotton in the jars (of which four were used for each of the six varieties tested) the sand was inoculated with an actively pathogenic isolate of the fungus and an additional inch of moist sand was spread over the surface of each jar before planting 20 sulphuric acid-delinted seeds. The nutrient solution, consisting of 12·5 ml. half molar calcium nitrate and 7·25 ml. of half molar solutions of each of the compounds ammonium nitrate, potassium acid phosphate, magnesium phosphate, and magnesium sulphate, made up to 10 qts with tap water, was added at the rate of 1 qt per jar daily, commencing the day after planting and continuing for the duration of the experiment (26th July to 18th September, 1937). Fresh inoculum was introduced into the soil through an inverted Buchner funnel on the 14th, 21st, and 28th days after planting. During the first five weeks of the test the mean daily air temperature of the greenhouse averaged 29·18°, i.e., near the optimum for infection under the prevailing conditions [ibid., viii, p. 101].

The following counts were made in the final disease analysis 54 days after planting. All the 40 plants of Half and Half (Summerour's) were dead, the corresponding figures for Misdel # 3, Rowden 2088 (Arkansas), Dixie Triumph # 6 (Arkansas), Rhyne's Cook, and Sea Island (Seabrook) being 36, 28, 21, 8, and 0, respectively. All the plants of the two first-named varieties showed external symptoms of the disease, the corresponding percentages for Rowden, Dixie Triumph, and Rhyne's Cook being 95, 85, and 57·5, respectively. Only 11 Sea Island plants were completely healthy, the remaining 29 showing internal discoloration though no outward sign of infection was evident. The first wilt in any variety (Rowden) was recorded on the 21st day and less than a week later all 40 plants of the most susceptible (Half and Half) were showing advanced wilt. Weekly observations were therefore necessary, time being obviously one of the factors concerned in the determination of resistance to this rapidly developing and virulent disease.

TERVET (I. W.) & ESSLEMONT (J. M.). **A fungous parasite of the eggs of the Gray Field Slug.**—*J. Quekett micr. Cl.*, Ser. 4, i, 1, pp. 1–3, 2 pl., 1938.

From unhatched eggs of the grey field slug (*Agriolimax agrestis*) in Scotland the writers isolated a fungus [which is described in detail] having characters in general agreement with those of *Verticillium chlamydosporium* Goddard (*Bot. Gaz.*, lvi, p. 249, 1913) [*R.A.M.*, xiv, p. 392], with which the present organism is accordingly identified. Points of difference include the larger chlamydospore dimensions of the Scottish fungus (36 to 60 by 27 to 37 μ, average 46 by 32 μ), and its capacity to impart a yellow colour to the medium.

In order to test the pathogenicity of *V. chlamydosporium* to eggs at various stages of development, 30 eggs were divided into five groups, of which A was watered with a spore suspension at one day old, B three

days later, C at 8, D at 12, and E at 15 days. None of the eggs of the first three groups developed, three out of six were killed in D, while all survived in the case of E. It would appear, therefore, that the time of infection exercises an important effect on the pathogen, which induces granulation and discoloration of the albumen and nuclear degeneration.

While *V. chlamydosporium* probably exerts a strong natural check on the reproduction of *A. agrestis* in the field (only 19 out of 733 eggs were hatched in a collection made at various times in December, 1936, and January and February, 1937), the possibility of its utilization for biological control purposes is considered to be remote.

Blattný [C.]. **Parasitace puklice plisněmi na podzimu 1937.** [Parasitization of scale insects by moulds in the autumn of 1937.]—*Ochr. Rost.*, xiv, 55, p. 81, 1938. [German summary on p. 98.]

The author states that over an extensive area in central Bohemia, Czechoslovakia, up to 90 per cent. of the larvae of the scale insect *Lecanium coryli-corni* on plums were killed during the autumn of 1937 by *Cephalosporium lecanii* [*R.A.M.*, xvi, p. 37] and *Cordyceps pistillariaeformis* [ibid., xiii, p. 302], of which the first-named was the more common.

Debré (R.) & Névot (A.). **Toxicité expérimentale des spores de charbon du Blé (Ustilago nuda f. tritici) chez la Souris.** [The toxicity, in experiments, of Wheat smut (*Ustilago nuda* f. *tritici*) spores to the Mouse.]—*C.R. Soc. Biol., Paris*, cxxvii, 11, pp. 977–979, 1938.

An etiological connexion having been demonstrated in Yugoslavia between the ingestion of smut (*Ustilago maidis*) [*U. zeae*]-contaminated maize and juvenile acrodynia [*R.A.M.*, xvi, p. 675], experiments were conducted at the Bacteriological Laboratory of the Faculty of Medicine, Paris, to determine the effect on mice of infection by loose smut of wheat (*Ustilago nuda* f. *tritici*) [*U. tritici*], introduced into the system either by the consumption of groats mixed with 4 or 8 per cent. spores of the fungus or by the subcutaneous injection of an aqueous spore extract. All the young mice contracted generalized hyperaemia, accompanied in most cases by posterior paralysis and in some by intense pruritus. Adult mice were not adversely affected by the ingestion of smutted groats.

Todd (Ramona L.). **The life cycle of Cryptococcus hominis.**—*Proc. Ia Acad. Sci., 1936*, xliii, pp. 81–85, 3 figs., 1937. [Received May, 1938.]

The results of the writer's studies at the Department of Hygiene, Preventive Medicine and Bacteriology, University of Iowa, on the life-cycle of *Cryptococcus hominis* [*Debaryomyces neoformans*: *R.A.M.*, xvii, p. 458], a parasite of man, have already been noticed from another source [ibid., xv, p. 802].

Dienst (R. B.). **Cryptococcus histolyticus isolated from subcutaneous tumor.**—*Arch. Derm. Syph., Chicago*, xxxvii, 3, pp. 461–464, 1938.

From a tumour on the tenth rib in a young negress the writer isolated *Cryptococcus histolyticus* [*Debaryomyces neoformans*: see preceding and next abstracts], which proved to be non-pathogenic to laboratory

animals when inoculated intraperitoneally. Subcutaneous abscesses could regularly be produced in rabbits, however, by intracutaneous inoculation, the first positive signs of infection occurring within 48 hours. Since carbohydrate fermentation by *D. neoformans* is a very slow process, it is important to hold subcultures for at least a month before recording reactions.

CUDMORE (J. H.). **Torula meningo-encephalitis: a case report.**—*Ann. intern. Med.*, xi, 9, pp. 1747–1752, 4 figs., 1938.

Full clinical details are given of a fatal case of meningo-encephalitis, associated with profuse infection by *Torula* in a 30-year-old white male at the City Hospital, New York.

CAVALLERO (C.). **Étude expérimentale sur les phénomènes de la variation et de la dissociation de Mycotorula albicans (Robin) Lang. et Tal.** [An experimental study of the phenomena of variation and dissociation in *Mycotorula albicans* (Robin) Lang. & Tal.]—*Boll. Sez. ital. Soc. int. Microbiol.*, x, 2, pp. 36–44, 1938.

In the course of further studies on ten strains of *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, pp. 176, 394] from various sources the author observed the formation of rough and smooth colonies associated with corresponding modifications in the characters of the organism. The smooth and rough strains were then cultured on media lacking and rich in nutrients, respectively, in order to separate the two types.

Under the experimental conditions, dissociation was gradual and progressive, and became evident in the appearance of intermediate forms possessing the characters of both the smooth and rough variants. This phenomenon was preceded by polymorphism and a pronounced polymetricism of the fungal elements, and occasionally by the development of atypical elements. The variation observed was always accompanied by morphological, biochemical, or pathogenic modification, or by modification in non-specific agglutination reaction.

It is concluded that even if differentiation into rough and smooth colonies is always associated with a variation in the other characters of *G. albicans*, the limits of such variations are extremely wide and cannot be definitely fixed, and that the smooth and rough phases are not altogether analogous with the corresponding phases described by Arkwright for bacteria of the typhus-coli-dysenteric group. While morphological characters vary, but invariably retain certain typical aspects, and fermentative characters also vary, but only within narrow limits, cultural characters and pathogenicity appear to be devoid of systematic value. Differentiation into rough and smooth phases would appear to be due entirely to factors associated with the medium.

WOOLLEY (MILDRED T.). **Mycological findings in sputum.**—*J. Lab. clin. Med.*, xxiii, 6, pp. 555–565, 6 figs., 1938.

Of 141 patients at two Arizona hospitals whose sputa were examined for the presence of fungi, 17 yielded positive results. *Monilia* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 320] was detected in eight cases and *M. candida* [*C. vulgaris*: ibid., xvii, p. 395] in one. An *Endomyces* accompanied

C. albicans in one case of pulmonary tuberculosis. The yeast-like organisms were classified on the basis of fermentation tests (in the course of which it was decided that lactose, dextrose, maltose, sucrose, and milk are sufficient for diagnostic procedures) and animal pathogenicity experiments, with satisfactory agreement between the two methods. Of the three *Aspergillus* spp. isolated, two were identified as *A. fumigatus* [ibid., xvi, p. 317] (pulmonary tuberculosis), this organism remaining in the sputa for 2½ years, and one (chronic non-specific pulmonary infection) as *A. niger*. The other organisms found during the survey included *Saccharomyces* sp. and *Torula* [*Torulopsis*] sp., both associated with a single case of sinusitis, and *Coccidioides immitis* [ibid., xvii, p. 394] in three patients suffering, respectively, from pulmonary tuberculosis, coccidiosis, and streptococcal pneumonia.

Turu (H.). **Ueber die aus Perlèche kultivierten Hefepilze.** [On the yeast fungi cultured from perlèche.]—Abs. in *Fukuoka Acta med.*, xxxi, 3, pp. 31–32, 1938.

From the corners of the mouths of 91 patients suffering from perlèche the writer isolated 53 strains of yeasts [*R.A.M.*, xvii, p. 177], of which 2 per cent. were placed, on the basis of their cultural and morphological characters and fermentation reactions, in the *Saccharomyces* group, 75 per cent. in *Myceloblastanon* [ibid., xvii, p. 241], 9 per cent. in *Mycoderma*, and 13 per cent. in *Cryptococcus*. All the 29 strains giving positive results in experiments on rabbits belonged to *Myceloblastanon*, which is evidently the principal agent of the disorder in Japan.

Williams (J. W.). **Reduction and concentration of methylene blue by certain pathogenic fungi.**—*J. Bact.*, xxxv, 3, pp. 305–309, 1938.

The ability to concentrate and reduce methylene blue is an important differential characteristic of certain human pathogens on the study of which the author is engaged [*R.A.M.*, xvi, p. 37]. A 0·001 per cent. concentration of the dye is ideal for the purpose in view. Basically the colour changes appear to be an expression of the oxidation and reduction reactions of the various constituents of the medium.

Fontana (A.). **Alcune ricerche di dermatologia e fitopatologia comparate.** [Some comparative studies on dermatology and phytopathology.]—*G. ital. Derm. Sif.*, lxxix, 1, pp. 19–29, 3 pl., 1938. **Nuove ricerche di dermatologia e fitopatologia comparate. Le acromie.** [New comparative studies on dermatology and phytopathology. The achromias.]—Ibid., 3, pp. 335–342, 1 pl., 1938.

Attention is directed towards some striking analogies observed by the writer in his studies in Italy between certain groups of human cutaneous disorders, including various types of ringworm and achromia, and a number of plant diseases of physiological, fungal, bacterial, virus, and animal origin.

Tcherniavsky (I. I.). **Fall von Chromoblastomykose.** [A case of chromoblastomycosis.]—*Vyestn. venerol. derm.*, *1937*, 9–10, pp. 923–925, 1937. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, pp. 202–203, 1938.]

Injury from a dirty plank on a bridge caused the development on the

leg of a 52-year-old workman of a conglomeration of pink, papillomatous, deep-seated abscesses, centring round a dark brown, spherical, stain-resistant body, the pus of which contained yeast-like cells developing on sugar agar into woolly, black colonies of mycelia and budding cells, the hyphae of the former producing terminal and lateral chains of conidia. The fungus [cf. *Hormodendrum rossicum*: *R.A.M.*, xii, p. 289] proved to be pathogenic to mice and it is suggested that these animals and rats may transmit the disease to man.

Fawcitt (R.). **The roentgenological recognition of certain bronchomycoses involving occupational risks.**—*Amer. J. Roentgenol.*, xxxix, 1, pp. 19–31, 15 figs., 1938.

Aspergillus spp., *Penicillium* spp., *Mucor* spp., and *Botrytis cinerea* were found in the sputa of a number of agricultural workers who had handled mouldy hay, grain, soil, or decaying vegetable matter in the north-west of England, and were suffering from distressing dyspnoea and other respiratory symptoms associated with certain roentgenographic appearances in their lungs. When recognized in an early stage the disease yields to potassium iodide and vaccine therapy. The occurrence of a similar condition was observed in miners of haematite iron ore from whose sputa were isolated *Trichoderma lignorum*, *Penicillium*, *Mucor*, and other fungi; it is thought that fungus infection may possibly be among the factors leading to silicosis. The author considers that fungi play a part, perhaps a major part, in these somewhat obscure, non-tuberculous conditions of the lungs, and it is suggested that the incidence of dust-borne fungi should be considered an occupational risk.

Oyama (T.). **Vitamin B und Dermatomyceten. I. Mitt. Einfluss des B-Vitamins auf die Dermatomyceten.** [Vitamin B and Dermatomycetes. Note I. The influence of vitamin B on the Dermatomycetes.]—*Nagasaki Igakkwai Zasshi*, xv, pp. 2601–2635, 1937. [Japanese, with German summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, p. 200, 1938.]

Most of the fungi (*Sporotrichum* and *Trichophyton* spp., yeasts, *Actinomyces*, *Aspergillus*, etc.) under observation at the Dermatological Clinic of Nagasaki University, Japan, responded by a marked increase of growth to the addition to Sabouraud's glucose agar or Fraenkel's medium of 0·5 to 5 per cent. of the vitamin B complex. The mycological features of the cultures underwent no striking change. On vitamin-free media the yeasts were the only group to develop resting stages. Rapid pleomorphism was induced in *Achorion gypseum* by the accessory growth substance.

Gougerot (H.) & Patte (A.). **Pityriasis versicolor réticulé.** [Reticulate pityriasis versicolor.]—*Bull. Soc. franç. Derm. Syph.*, *1938*, 3, pp. 416–417, 1938.

Full clinical details are given of a case of atypical pityriasis versicolor, caused by *Malassezia furfur* [*R.A.M.*, xvii, p. 243], in a 30-year-old metallurgical worker in Paris. The remarkable reticulate distribution of the coffee-coloured lesions along the anastomotic network of the

cutaneous capillaries was closely followed by the aid of Wood's rays, which revealed unsuspected sites of infection and greatly facilitated the diagnosis and treatment of the disorder [ibid., xvii, p. 175].

MARKOVIĆ (A.) & PANTIĆ (M.). **Der Favus im Heere. (Die Art der Behandlung und die erzielten Resultate im Hauptmilitärspitale im Jahre 1935, 1936 und 1937.)** [Favus in the Army. (The manner of treatment and the results secured in the chief military hospital in the years 1935, 1936, and 1937.)]—*Voenn. sanit. Glasn.*, viii, pp. 551–558, 1937. [Serbocroatian, with German summary on p. 556. Abs. in *Zbl. Haut- u. GeschlKr.*, lix, 3–4, p. 202, 1938.]

From 1935 to 1937 the cases of favus in the Yugoslavian Army numbered 151, all being authenticated by clinical diagnosis and microscopic examination, which consistently yielded *Achorion schoenleini* [*R.A.M.*, xvii, p. 395]. Particulars are given of the therapeutic methods (Röntgen epilation) employed in the control of the disorder.

TANNER (F. W.) & HOFER (J. W.). **Thermal death-time studies of Oospora lactis.**—*Food Res.*, ii, 6, pp. 505–513, 1937.

None of the 224 wort agar cultures of *Oospora lactis* [*R.A.M.*, xvii, pp. 179, 245] isolated from cream samples from seven States proved capable of resisting pasteurization in cream at 62·8° C. (145° F.) for 30 minutes in tests at the Department of Bacteriology, Illinois University. Eight out of 144 cultures survived exposure for the same period to a temperature of 57·2° (135°) and none succumbed at 51·7° (125°).

VALLEGA (J.). **Observaciones sobre la resistencia a la roya de algunos Linos ensayados en el Instituto fitotecnico de Llavallol.** [Observations on the resistance to rust of some Flax varieties tested at the Phytotechnical Institute of Llavallol.]—*Rev. argent. Agron.*, v, 1, pp. 25–56, 1938.

Flax rust (*Melampsora lini*), known in the Argentine [*R.A.M.*, xi, p. 300] since 1883, comprises at least two physiologic races distinct from those occurring in the United States [ibid., xvii, pp. 323, 396], one resembling (according to H. H. Flor *in litt.*) the form of the rust encountered in Uruguay and the other characterized by its pathogenicity to the ordinarily immune Ottawa 770 B. variety. During the last three years the indigenous population of the rust appears to have undergone a change of constitution, as judged by the reaction of certain varieties tested at the Llavallol Phytotechnical Institute, where both Ottawa 770 B. and Italia-Roma, immune in the epidemic season of 1934, have since become susceptible.

Although *M. lini* is a heterothallic fungus, the apparent absence from the Argentine of the aecidial and pycnidial stages of its life-cycle limits the possibilities of the development of new physiologic races through hybridization, and rather suggests their introduction on imported material or the occurrence of mutation. The rust is perpetuated by means of the teleutospores adhering to the stubble or mixed with the seed, while successive cycles of the uredospore stage are completed on diseased plants. Rust infection is favoured by late sowing in a warm, humid atmosphere, which induces the prolific growth neces-

sary to provide an ideal substratum for the parasite. Plants debilitated by adverse physiological conditions or wilt (*F*[*usarium*] *lini*) are relatively resistant to *M. lini*.

All the native flax varieties and strains actually under cultivation in the Argentine were shown by the experiments herein described and tabulated to be more or less susceptible to the very virulent endemic races of the rust, among the most resistant being *Z. 195* I.F. 587; *Z. 176* I.F. 586; *Klein 10 e* I.F. 595; *Klein 11 o* I.F. 429; and White-flowered Pergamino Selection 6003 I.F. 474. Of the foreign varieties included in the trials, most of the Indian and Chilean proved to be highly susceptible, while among the more resistant may be mentioned Bombay I.F. 516; Punjab I.F. 869; J.W.S. I.F. 830; T. Tammes flax I.F. 1036; Sorauer Feinflachs I.F. 982; Gillwald's Rica I.F. 842; and Concurrent I.F. 928. Resistance to *M. lini* does not appear from the writer's observations to be correlated with the origin of the material, type of flax (fibre or seed), or flower colour.

BUDDIN (W.). **The grey bulb rot of Tulips and its control.**—*J. Minist. Agric.*, xliv, 12, pp. 1158–1159, 1938.

In this brief note the author gives the results of further experiments which show that in the control of *Sclerotium tuliparum* [*R.A.M.*, xvi, p. 614] sprinkling the soil after planting the bulbs with a powder containing chloronitrobenzol was unsatisfactory, whereas when the powder was mixed with the surface soil 90 per cent. control was obtained.

KAWAMURA (T.). **So-called virus diseases of Lily in relation to hosts.**—*Ann. phytopath. Soc. Japan*, vii, 3–4, pp. 163–172, 2 pl., 3 figs., 1938.

In addition to two types of mosaic [*R.A.M.*, xvi, p. 752], namely, green mottling of the leaves and necrotic yellow leaf-streaking, three other types of (presumably) virus disease affect lilies in Japan, viz., 'crook neck' (ascribed by Guterman in the United States to the lily mosaic virus), 'rosette' [ibid., xvi, p. 797], and 'pimple leaf'.

In the summer of 1935 about 50 plants of *Lilium auratum* at Yokohama suddenly became affected with crook neck, though *L. longiflorum* and *L. speciosum* in the immediate vicinity were unaffected. The leaves turned yellow near the apex of the stem, and dried up, assuming a brownish colour; finally complete defoliation occurred, and only a bare, crooked stem, resembling a walking-stick handle remained. No pathogenic organisms were found in connexion with the disease and the tissues appeared to be quite normal.

In true rosette the internodes are shortened, whereas in yellow flat there is a curling down and sometimes a twisting of the leaves, unaccompanied by mottling, streaking, or deformation. The latter type does not always occur among lilies affected with this virus, which sometimes causes the plant to assume a dwarfed or cylindrical shape. In general, the true rosette type is more common than yellow flat; under greenhouse conditions the downward leaf-curling and plant-dwarfing may be reduced, while out of doors these symptoms are strongly marked.

Pimple leaf causes swelling of the leaves and stunting of the plants

on Easter lilies. It has been known in New York for some years, and has also occurred for several seasons on *L. longiflorum* var. *erabu* in greenhouses at Yokohama, where the author formerly confused it with frost injury. In 1936 the condition was observed on *L. longiflorum* in Japan both in the field and in the greenhouse, the flower bud being affected in both cases; the affected plants showed a special deformation of the leaves without mottling or discoloration, but accompanied by severe stunting, as in green mosaic. In pimple leaf the epidermal, and especially the palisade, cells are distinctly swollen, and in many cases lose their chloroplasts.

The paper concludes with a table showing the types of virus symptom (green mottled mosaic, yellow streaked mosaic, yellow flat or rosette, crook neck, pimple leaf, mosaic of unknown symptom, and unaffected) found by the author during a period of several years on 39 lily varieties in Japan.

Săvulescu (T.) & Săvulescu (Olga). **Une espèce d'Uromyces sur les feuilles de Rosa.** [A species of *Uromyces* on the leaves of *Rosa*.]—Reprinted from 'Grigore Antipa' Jubilee Volume, 7 pp., 3 figs., [? 1938].

The following species of *Phragmidium* [*R.A.M.*, xvii, p. 459] have been found on roses in Rumania: *P. disciflorum* [*P. mucronatum*: ibid., xvi, p. 826] on *Rosa canina*, *R. dumetorum*, *R. gallica*, *R. pomifera*, *R. centifolia*, *R. coriifolia*, and *R.* sp., *P. fusiforme* (= *P. rosae-alpinae* (DC) Winter) on *R. pendulina*, *P. rosae-pimpinellifoliae* Diet. on the branches and petioles of *R. pimpinellifolia* (the first record of this species in Rumania), and *P. tuberculatum* J. Miller on *R. canina*.

In 1933 the authors found living leaves of *R. lutea* in Bessarabia bearing on the lower surface the uredosori and teleutosori of a species of *Uromyces*, which they name *U. antipae* n.sp. [with a Latin diagnosis], characterized by globose, ellipsoidal, or elongated, echinulate uredospores measuring 16 to 26·5 by 13 to 16 μ and having 4 to 6 germ pores arranged equatorially; and dark chestnut or dark brown, pulverulent, sparse teleutosori, with variously shaped, generally elongated, often obtuse-angled teleutospores measuring 23 to 33·5 by 16 to 23 μ, provided with a wide, flat, subhyaline papilla at the apex, rounded at the base, surrounded by a finely punctate, brown epispore uniformly 2 to 2·5 μ thick, and borne on a subpersistent, hyaline, thin pedicel 3 to 10 μ long.

Green (D. E.). **Downy mildew on Antirrhinum.**—*J. R. hort. Soc.*, lxiii, 4, pp. 159–165, 2 pl., 4 figs., 1938.

In this expanded account of the writer's studies on downy mildew of *Antirrhinum majus*, reported from southern Ireland in 1936 and from Sussex in 1937 [*R.A.M.*, xvi, p. 815], it is mentioned that some doubt still exists as to the identity of the causal organism with *Peronospora antirrhini*. The oospores of the fungus examined by the writer are larger (30 to 38 μ in diameter) than those described by Schroeter (*Hedwigia*, xiii, p. 183, 1874) for *P. antirrhini* (28 to 32 μ) on *A. orontium*, while the conidiophore mats formed on the under side of the leaves by the British organism are mealy-white to yellowish-brown instead of violet, as originally reported.

Disappointing results were given by experiments in the control of the disease with liver of sulphur, and about 20,000 plants suspected of downy mildew infection had to be destroyed in the Wisley district of Surrey in 1937. Growers are advised to burn affected plants, sterilize the soil in which they were growing, e.g., with 2 per cent. formalin, and treat the remaining healthy plants with Bordeaux mixture or a cupric dust.

Diseases of the Carob tree.—*Cyprus agric. J.*, xxxiii, 1, p. 28, 1938.

Carob trees [*Ceratonia siliqua*] in Cyprus, especially when in a weakened condition, sometimes show leaf and pod infection by *Cercospora ceratoniae* [*R.A.M.*, iv, p. 562], which produces circular spots up to 1 cm. in diameter. The tree is also affected by *Oidium ceratoniae* [ibid., vii, pp. 539, 557], which occurs on leaves and pods and may slightly deform the latter when young. Of the more serious carob diseases, caused by fungi attacking the trunk and main branches, the commonest is *Ganoderma applanatum*.

McKay (R.). **Spraying experiments for the control of Apple scab in 1935 and 1936.**—*J. Dep. Agric. Eire*, xxxv, 1, pp. 42–57, 4 pl., 1938.

In spraying tests carried out in Eire in 1936, three applications of Bordeaux mixture, made with hydrated lime (8–12–100), to Bramley's Seedling apples gave 96·7 per cent. fruits unaffected by scab [*Venturia inaequalis*], as against only 12·5 per cent. clean fruits in the controls. Three and four applications of Bordeaux mixture made with quicklime (3–10–40) gave, respectively, 85 and 98·4 per cent. clean fruits on Bramley's Seedling, while three applications gave 99·3 per cent. clean fruits on Newton Wonder trees. Both types of Bordeaux mixture when applied after petal fall result in injury to the foliage and fruit and two successive years' trials demonstrated that the 8–12–100 formula is altogether unsuited to Irish climatic conditions.

Three and four applications of lime-sulphur (pre-blossom, 1 in 30, post-blossom 1 in 60, and 1 in 80) gave 45·5 to 69·4 per cent. clean fruits on Bramley's Seedling, with no fruit or foliage injury, and on Bismarck 19·7 to 78·9 per cent. clean fruits, as against 99·6 per cent. severely scabbed fruits in the controls. On Allington Pippin three lime-sulphur applications gave 68·1 per cent. clean fruits, as against 19·7 per cent. in the controls. Scab infections on young wood were observed on the Bramley's Seedling and Newton Wonder varieties.

Cheal (W. F.). **Apple scab spraying experiments in the Wisbech area. IV.**—*J. Minist. Agric.*, xliv, 12, pp. 1184–1188, 1 diag., 1938.

Further spraying tests carried out in the Wisbech area of Cambridge since 1934 [*R.A.M.*, xiv, p. 590] have conclusively demonstrated that two heavy pre-blossom applications of lime-sulphur (1 in 80) are, under the conditions prevailing locally, essential for the successful control of apple scab [*Venturia inaequalis*], not only on wood-susceptible varieties but on others also, including Bramley's Seedling. A few days' delay in spraying at the green flower stage is fatal in a year of bad infection.

Report of the Department of Agriculture, Province of Nova Scotia, for the year ended November 30, 1937.—3 pl., 2 graphs, 1938.

The following items are included in this report. In an orchard of Gravensteins and Ribstons at Starr's Point the following were the averages in a ten-year (1928 to 1937) comparative spraying experiment against apple scab [*Venturia inaequalis*]: standard Bordeaux schedule, scab 2·04 per cent., clean fruit 79·11 per cent., bush. per tree 5·23 (excluding 1928); lime-sulphur 3·54, 80·72, and 5·07, respectively; Nova Scotia iron sulphate schedule 3·65, 81·26, and 5·41, respectively (changing from aluminium to iron sulphate in 1933 and to 60 per cent. iron sulphate mixture in 1936); 85–15 sulphur lead dust, 10·77, 69·20, and 6·13 (Gravensteins only), respectively; and untreated 25·45, 49·04, and 5·82, respectively. In 1936–7 at Mount Denson the lowest incidence of scab (3·9 per cent. as compared with 82·80 per cent. in the untreated plots) was obtained on Starks and Baxters with Bordeaux mixture and the highest percentage (89·87) of clean fruit with flotation sulphur. In 1937 copper hydro 40 flotation reduced the amount of scab on Starks from 89·2 to 0·7 per cent., the corresponding figures for lime-sulphur+catalytic sulphur, Bordeaux flotation, lime-sulphur+flotation mixture, lime-sulphur+magnetic mixture, lime-sulphur-wettex mixture, coposil flotation, and lime-sulphur-lead arsenate being 2, 2·8, 2·6, 1·9, 1·9, 1, and 2·9 per cent., respectively. Lime-sulphur-wettex mixture gave the largest amount of clean fruit (94·9 per cent.).

Dunne (T. C.). **'Wither tip' or 'summer dieback', a copper deficiency disease of Apple trees.**—*J. Dep. Agric. W. Aust.*, xv, 1, pp. 120–126, 3 figs., 1938.

Apple trees in Western Australia have for many years been affected by a condition known locally as 'wither tip' or 'summer die-back'. The disease chiefly attacks trees in leached soils, or in soils supporting forests of *Eucalyptus diversicola*. Old and young trees are affected, but in localities where clay layers are present under light surface soils young trees often recover after a few years.

Badly affected trees generally have a stunted, bushy growth habit, due to the inability to develop a leader system. The condition develops as a rule on vigorously growing shoots. Brown spots appear on the terminal leaves in November or December, followed by small necrotic areas; leaves developing subsequently become more severely affected, wither up, and fall. The upper portion of the shoot, to a distance of 3 to 12 in., then withers and dies. The buds on the shoot below the withered part remain healthy, and new growths are frequently produced from the top ones in March. After winter pruning, vigorous growth is generally obtained from shoots whose tips were withered during the previous season.

Of the locally grown commercial varieties Yates is most susceptible, followed by Granny Smith, Jonathan, Cleopatra, and Democrat. Cox's Orange Pippin is usually very badly affected.

In two seasons' tests on Yates and Granny Smith trees copper sulphate applications to the soil [cf. *R.A.M.*, xv, p. 730] at the rate of 2 lb. per tree, trunk (A.R. salt [crystals]) and limb (0·025 and 0·01

per cent. solution) injections, and spraying the leaves with Bordeaux mixture (3–3–40) all produced marked improvement, though similar treatments with zinc and other chemicals had no effect. That the affected trees were suffering from copper deficiency was confirmed by analysis of the leaves of diseased and healthy trees. It is concluded that while spraying with Bordeaux mixture is sufficient to control the condition in young trees, with older trees both soil and spray applications of copper should be made in the first year, followed thereafter by soil applications only.

ROSEN (H. R.). **Life span and morphology of fire blight bacteria as influenced by relative humidity, temperature, and nutrition.**— *J. agric. Res.*, lvi, 4, pp. 239–258, 3 pl., 1938.

In the course of a study on the combined influence of temperature and relative humidity on the fireblight organism *Erwinia amylovora* [*R.A.M.*, xvii, p. 401] the natural bacterial exudate was subjected to a controlled temperature of 16° C., and the bacteria remained viable and infectious for over a year at relative humidities of 0, 9·5, 21, and 45 per cent.; at controlled temperatures of 25°, 30°, 35°, and 40° the bacteria remained viable for long periods when the relative humidity was low, but they died at 45 per cent. saturation. When the exudate was exposed to fluctuating outdoor temperatures the bacteria remained viable for almost a year at relative humidity 0 per cent. and for over 9 months at 50 per cent., but died rapidly at 75 and 90 per cent. Exposed to fluctuating temperatures in the laboratory, the bacteria remained viable for 610 days at a relative humidity of 0 per cent. Bacteria within blighted host tissue lived for approximately the same length of time as those in the natural exudate at low relative humidities, while bacteria in artificial cultures were very short-lived under similar conditions. When minute droplets of exudate were immersed in honey in combs kept outdoors in U.S. Weather Bureau-type housing [meteorological screen] the bacteria were found to be viable after 22 days and dead after 92 days; when bits of blighted host tissue were immersed in honey in the same way the bacteria were viable after 121 days. A morphological study of the organism indicates that bacteria derived from exudate are enveloped in slimy, mainly non-proteinaceous capsules, while in bacteria derived from pure cultures there is either no capsule or only traces of it. It is concluded that the presence or absence of capsules influences the longevity of the bacteria. As to the sources of inoculum for the earliest or primary infection on apple and pear trees, it remains to be determined whether the bacteria are carried over from one year to the next in the form of exudate.

JØRSTAD (I.). **Gymnosporangium on Pomaceous fruits in Norway.**— *Nyt. Mag. Naturv.*, lxxviii, pp. 121–126, 3 figs., 1938. [Norwegian summary.]

All the three species of *Gymnosporangium* occurring in Norway are capable of producing aecidia (*Roestelia*) on the fruits of their respective aecidial hosts, namely, *G. clavariaeforme* on hawthorn (*Crataegus* spp.) and pear, *G. juniperi* on *Sorbus* [*Pyrus*] *aucuparia*, and *G. tremelloides* on apple [*R.A.M.*, xv, p. 609]. In 1937 the last-named was exceptionally

severe in the apple-growing districts of Sogn and Hardanger, producing conspicuous pycnidial lesions at the blossom end of the fruits, especially on the Prinsar, James Grieve, and Torstein varieties, Fillippa, Bramley's Seedling, and Gravenstein being comparatively little damaged. In November the writer received a batch of Signe Tillisch apples with well-developed aecidia of *G. tremelloides* at the blossom end; in some instances *Gloeosporium fructigena* [*Glomerella cingulata*] had produced rotting at the sites of aecidial infection. A consignment of Torsteins showing a similar aecidial development of *Gymnosporangium tremelloides* was submitted for inspection from another locality during the same month, accompanied by a report to the effect that the rust was present on most of the apples used in fruit-packing demonstrations at various places in Sogn, frequently necessitating relegation to inferior grades; Signe Tillisch was the most susceptible variety and the yellow Kaupanger the least so.

The occurrence of *G. clavariaeforme* on pear fruits is very sporadic in Norway, where it has been observed in various districts on the Empress, Bergamotte lucrative, Tongres, and Double Philip varieties. The aecidia are confined to the fruits, which may be attacked both at an early and advanced stage of growth. In 1937 this rust was found in the Botanic Garden at Oslo, for the first time since 1895, on *C. oxyacantha*, *C. macracantha*, and *C. sanguinea* var. *chlorocarpa*, causing pronounced hypertrophy of the berries on the last-named.

GROVES (A. B.). **The relation of concentration of fungicides and bud development to control of Peach leaf curl.**—*Phytopathology*, xxviii, 3, pp. 170–179, 1 fig., 1938.

In a series of experiments from 1933 to 1937 in the control of leaf curl (*Exoascus* [*Taphrina*] *deformans*) on Elberta peaches at the Virginia Agricultural Experiment Station [*R.A.M.*, xvii, p. 255], satisfactory results were obtained by the use of much weaker concentrations of fungicides than those usually recommended. The disease was successfully combated by lime-sulphur 1 in 50, Bordeaux mixture 2–4–100, wettable sulphurs (dry lime, dritomic, dry flotation, and kolofog) 16 lb. in 100 gals., and soluble sulphur (dry sodium polysulphides) 8 lb. in 100 gals.

Sprays of lime-sulphur 1 in 40 applied after the leaves were protruding as much as 1 in. from the buds were effective against leaf curl.

VIELWERTH (V.) & SLINK-MEZENCEVOVÁ (Mme A.). **Pokusy s Moniliovou infekcí Meruněk.** [Experimental infection of Apricots with *Monilia*.]—*Ochr. Rost.*, xiv, 55, pp. 47–50, 1938. [German summary.]

The results of inoculation experiments in 1937 [some details of which are given] showed that *Monilia* [*Sclerotinia*] *laxa* [*R.A.M.*, xvi, p. 623; xvii, p. 441; and above, p. 501] is not able to penetrate the unwounded bark of apricot stems; infections were more numerous when the inoculum was applied to wounds in the bark cut horizontally than when it was applied to longitudinal wounds, indicating that the infective capacities of the fungus are largely dependent on the healing power of the injured tissues. Wound inoculations gave positive results only when

made in the first two weeks of May; later ones (20th May) consistently yielded negative results. These findings are considered to indicate that *S. laxa* is not the primary cause of apoplexy of apricot trees, though the fungus is almost invariably found on dying or dead trees which it enters through the numerous necrotic spots in the bark.

POHL (H.). **Die Rutenkrankheit bei Himbeeren.** [Cane blight of Raspberries.]—*Obst- u. Gemüseb.*, lxxxiv, 3, pp. 32–33, 1938.

In order to protect raspberry plantings of the valuable Preussen variety against the disastrous effects of cane blight [*Didymella applanata*: *R.A.M.*, xiv, p. 775], German growers are advised to apply to the soil large quantities of lime and related mineral substances, preferably in the form of plant ashes, which usually contain up to 30 per cent. or more lime and a high proportion of potash. The disease chiefly affects old plantings and in severe cases it may be necessary to uproot the infected bushes and replant fresh material on a new site. The Harz Jewel variety appears to combine resistance to cane blight with other desirable characters and should be cultivated in trial plantings to determine its suitability in different types of soil.

CHAMBERLAIN (G. C.). **Yellow blotch-curl: a new virus disease of the red Raspberry in Ontario.**—*Canad. J. Res.*, Sect. C, xvi, 3, pp. 118–124, 2 pl., 1938.

Cuthbert red raspberries in Ontario were in 1935 observed to be affected by a disease (presumably present for some years but previously undetected) characterized by reduction in the number of canes and a remarkable dwarfing and stunting. The affected stools were thin, spindly, and lacking in vigour, the canes exhibiting an erect, stiff growth, and bearing pale, chlorotic, lustreless leaves which rattled when the canes were shaken. Owing to shortening of the internodes, especially in the apical parts, the leaflets appeared in a cluster formation, which was accentuated by a loose type of curling, in which the leaves became arched, the tips curling downwards and inwards. On some canes a few of the older basal leaflets showed a coarse, yellow blotching and spotting, often as definite ring spots.

The disease, which is termed 'yellow blotch-curl', was experimentally transmitted in 60 out of 100 attempts by patch-grafting to the Cuthbert, Viking, Latham, Herbert, Chief, and Lloyd George varieties, and is considered to be of virus origin. The various types of symptom expression on these varieties are described in detail. All nine attempts at transmission to black raspberries were unsuccessful.

In all cases where transmission was effected, infection did not become systemic until the second year. Symptoms appeared first on lateral branches, most frequently those nearest the graft. June or early July were the most favourable times for transmission by grafting, and unless grafts were made then, symptoms did not appear on the current season's growth.

SMART (HELEN F.). **Microbiological studies on cultivated Blueberries in frozen pack.**—*Food Res.*, ii, 5, pp. 429–434, 1937.

The microbial content of fresh cultivated blueberries (*Vaccinium*

corymbosum) of the Cabot, Concord, Pioneer, Rancocas, and Rubel varieties from New Jersey was found to range from 100,000 to over 1,000,000 organisms per gm., chiefly *Botrytis* sp., *Cladosporium* sp., *Monilia* sp., *Penicillium* sp., *Rhizopus* sp., *Sclerotinia* sp., and three types of yeast, including pink, white, and black species of *Saccharomyces*. Less than 1 per cent. of the micro-organisms survived the storage period of seven months in the frozen berries [cf. *R.A.M.*, xiv, p. 322], but those remaining alive (chiefly species of *Monilia*, *Penicillium*, *Rhizopus*, and *Saccharomyces*) sufficed to cause rapid spoilage of the fruit at room temperature. The wholesomeness of the frozen berries is not impaired by the surviving micro-organisms provided they are consumed reasonably soon after thawing, or transferred to a refrigerator.

ENDO (Y.) & KURASAWA (T.). **On a strange virosis of the Mulberry tree.**—*Bull. Seric. Silk Industr., Uyeda*, ix, pp. 115–132, 4 pl., 6 figs., 1937. [Abs. in *Jap. J. Bot.*, ix, 2, p. (34), 1938.]

The authors state that a virus disease of mulberries is prevalent in various parts of Japan [cf. *R.A.M.*, xv, p. 386] and is characterized by foliar mottling, thickening of the mesophyll, clearing of the leaf veins and interveinal areas, production of enations on the under surfaces of the leaves, complete suppression of the lamina causing filiform development, and clustering of the leaves at the shoot apex. Silkworms cannot be fed on the affected foliage. Diseased trees ultimately cease growth and die. No micro-organisms have been observed in the infected tissues, but various cells were found to contain 'X-bodies'.

BROOKS (C.) & MCCOLLOCH (L. P.). **Spotting of Figs on the market.**—*J. agric. Res.*, lvi, 7, pp. 473–488, 6 figs., 3 diags., 3 graphs, 1938.

Figs poorly refrigerated in transit or held on the market in the United States are liable to develop a surface spotting that seriously lowers their market value. Fruits of all varieties from both the Atlantic and the Pacific coasts are affected. The spotting is largely confined to fully ripe fruit and is favoured by skin cracks and by the sugary solution often found on the surface of the fig. From affected figs the authors isolated mainly *Alternaria tenuis* but also *Cladosporium herbarum* and *Botrytis* [cf. *R.A.M.*, xiii, p. 41]. The strains of *A. tenuis* from Californian and Virginian figs are believed to be distinct, producing slightly different spotting and showing differences in growth in culture. Storage of figs at a low humidity (65 per cent.) entirely prevented the development of the spots, but the fruit became badly shrivelled. *A. tenuis* grew on potato dextrose agar approximately twice as rapidly at 77° F. as at 59°, about twice as rapidly at 68° as at 50°, nearly three times as rapidly at 59° as at 41°, and fully three times as rapidly at 41° as at 32°. Temperature studies with *C. herbarum* yielded similar results. Exposure to 30 per cent. carbon dioxide for 2 days at temperatures of 41°, 50°, 59°, 68°, and 77° delayed the growth of the fungus for about $1\frac{1}{3}$ days, reducing the activity to about one-third of normal. Exposure to an average concentration of 23 per cent. or more carbon dioxide in pony refrigerators gave as good control of the spotting as immediate storage at 32°.

EDSON (H. A.). **United States of America: Cephalosporium wilt of Persimmon.**—*Int. Bull. Pl. Prot.*, xii, 3, p. 53, 1938.

In connexion with the destructive *Cephalosporium* wilt of persimmons (*Diospyros virginiana*) recently reported from central Tennessee [*R.A.M.*, xvii, p. 405], the writer states that the original centre of infection, probably dating from 1933 or 1934, is now entirely devoid of living trees, while in adjacent areas 80 per cent. of the stands are dead and the remainder infected.

BITANCOURT (A. A.). **A anthracnose da Mangueira.** [Mango anthracnose.]—*Biologico*, iv, 2, pp. 43–45, 1 fig., 1938.

In giving a brief popular account of the various lesions caused by *Colletotrichum gloeosporioides* [*R.A.M.*, xvii, p. 403] on the mango and its fruits, the author states that the most dangerous form of attack by the parasite is blossom blight, since in severe cases a tree may lose its entire crop. The disease is not easy to control, especially in highly susceptible varieties. During the dormant season all diseased wood should be removed and burned. Pruning should also afford the maximum aeration and insolation to the crown. Spraying with 1 or 1·5 per cent. Bordeaux mixture should be started as soon as the blossom buds begin to swell, and should be repeated every four days until all the flowers on the trees are fully developed, i.e., over a period of 10 to 15 days under the local conditions in Brazil; one or two applications of the spray should be given after the fruits are set.

WILCOXON (F.) & MCCALLAN (S. E. A.). **The weathering of Bordeaux mixture.**—*Contr. Boyce Thompson Inst.*, ix, 3, pp. 149–159, 1 fig., 5 graphs, 1938.

In continuation of their studies on Bordeaux mixture [*R.A.M.*, xv, p. 733], the authors give an account of experiments to determine the changes that occur in the chemical composition of the spray residue on glass slides during exposure, after drying in the laboratory, to the action of weather conditions out of doors. The main determinations were made with 4–4–50 Bordeaux mixture, which was sprayed on circular glass plates (225 sq. cm. in area) as uniformly as possible for from 30 to 50 seconds, the duration of application being constant for any one experiment. Approximately 1·5 to 4 mg. of copper were thus deposited on each plate. The results indicated that under the leaching influence of rain and dew the spray deposit undergoes a continual change of composition. The excess lime in the mixture is carbonated quite rapidly, after which calcium and sulphate are removed by rain and dew at a greater rate than copper, leaving a residue relatively richer in copper as weathering proceeds. This process is accompanied by an increase in soluble copper, the highest observed amount of which was 0·45 mg. per plate, when the plate was agitated with 50 c.c. of water. Carbonation of the excess lime was complete in a few hours, but the increases in soluble copper did not occur until much later. While these results could be duplicated in the laboratory using artificial rain playing on dried films of Bordeaux mixture, washing the Bordeaux precipitate in bulk by centrifuging or on a Buchner funnel did not lead to substantial

increases in soluble copper. In the dried deposits of Bordeaux mixtures low in lime exposed to the leaching effect of rain, soluble copper appeared sooner than with 4–4–50 mixtures. Treatment of the sprayed films with carbon dioxide, either wet or dry, did not lead to much increase in soluble copper. It is considered that the increases in soluble copper observed can be best explained by assuming that the weathered Bordeaux precipitate is an adsorption complex or a solid solution containing copper, lime, and sulphate, the copper of which is soluble in water to an extent which varies with its composition. It is further believed that the appearance of small amounts of soluble copper in the Bordeaux mixture deposits may be a factor in connexion with foliage injury, and also in the fungicidal action of the spray by supplementing the solvent action of spore excretions previously reported [loc. cit.].

McCallan (S. E. A.) & Wilcoxon (F.). **Laboratory comparison of copper fungicides.**—*Contr. Boyce Thompson Inst.*, ix, 3, pp. 249–263, 4 graphs, 1938.

This is a summarized account of laboratory comparisons, by methods described in previous communications [see preceding abstract *et passim*], of the toxicity, adherence, and injurious action on host foliage of 4–4–50 Bordeaux mixture and nine other representative copper compounds manufactured in the United States [a list of which is appended], in which the evaluations were based on equal copper concentrations in the sprays tested. Details are also given of a method for calculating the Ld 50 (concentration permitting 50 per cent. of the spores to germinate) and its standard deviation from the toxicity curves of compounds tested in the laboratory. In the toxicity tests spore suspensions (adjusted to contain approximately 45,000 to 65,000 spores per c.c.) of *Sclerotinia fructicola*, *Botrytis cinerea*, *Alternaria solani*, *Glomerella cingulata*, *Uromyces caryophyllinus*, or *Gymnoconia peckiana* were pipetted on to glass slides covered with a dried film of the spray tested, both before and after the slides had been exposed for one minute to laboratory 'rain', regulated to give from 0·5 to 0·6 in. of rainfall in this period. Taken as a whole, the results showed that the compounds may be grouped in three classes, with Bordeaux mixture alone in the first; in every case (except *G. peckiana*) this mixture was from 4 to 20 times more toxic than the next best compounds, and 180 to 1,800 times more toxic than the least effective. The third class, low in toxicity, consists of copper phosphate and basic copper sulphate, and the remaining preparations fall into an intermediate class, in which Oxo Bordeaux and coposil are probably the most and copper zeolite the least toxic. Adherence tests based on chemical analyses and toxicity before and after exposure to laboratory 'rain' showed that Bordeaux mixture, cuprocide, and copper oxychloride were the most adherent, and copper oxalate and basic copper sulphate the least. The results of limited greenhouse tests on lettuce, buckwheat, bush beans (*Phaseolus vulgaris*), and maize, and in the open on peach and apple indicated that in general the compounds most toxic to the spores were also the most toxic to the leaves. The difference in injury to the foliage was not, however, as great as that in the fungicidal properties, and all the compounds tested in the open caused injury to some extent. Copper

zeolite, copper-hydro '40', copper phosphate, and copper oxalate produced less injury than Bordeaux mixture, whereas the remainder equalled or surpassed it in toxicity to the leaves.

From these results, and from a survey of the relevant recent literature [most of which has been noticed in this *Review*], the authors conclude that fifty years of experimentation with copper compounds have given none equal to Bordeaux mixture in fungicidal value. In special cases, however, such as lime-sensitive plants, certain other compounds, with lower phytocidal properties, may be more desirable than Bordeaux mixture.

GOLDSWORTHY (M. C.) & GREEN (E. L.). **Effect of low concentrations of copper on germination and growth of conidia of Sclerotinia fructicola and Glomerella cingulata.**—*J. agric. Res.*, lvi, 7, pp. 489–505, 1 diag., 1938.

In this study the authors demonstrated the effect of low concentrations of copper ions on the activity of the conidia of *Sclerotinia fructicola* and *Glomerella cingulata* [*R.A.M.*, xv, pp. 595, 733] in two different ways. By the first method the conidia, embedded in water agar, were placed for 24 hours in an apparatus in which the concentration of copper ions was kept practically constant by means of a controlled gravity flow of the solutions. This 'dynamic' system is believed to resemble more or less the natural condition of a conidium suspended in a drop of rain-water on the deposit from a copper-containing spray, any copper absorbed by the conidium being replaced from the deposit. By the second method the conidia embedded in water agar were exposed to certain concentrations of copper ions added to water, Czapek's, and potato agars, and in this static system the copper concentration was gradually decreased. It was found that the degree of toxicity of ionic copper was higher in the dynamic system, where the conidia of both species were definitely injured by concentrations of ionic copper as low as 0·25 p.p.m., than in the static system, where it varied with the power of the various media to fix, and consequently to inactivate, the copper ions; the amount of fixation appeared to be greatly influenced by direct adsorption or by combination with alcohol hydroxyl groups. The results obtained from the saturated solutions of various copper compounds indicate that although their solubilities appear to be positively correlated with injury when in contact with the tender parts of sprayed plants, yet it is the amount of available rather than of soluble copper which determines the degree of toxicity to the conidia. Thus basic copper sulphate, with a solubility of 11·5 p.p.m., was more toxic than a saturated solution of copper malate, with a solubility of 1,240 p.p.m., the available copper in the former being apparently greater than in the latter. The saturated solutions of cupric oxide (black), copper phosphate, copper zeolite, copper ammonium silicate, and copper silicate were non-toxic to the conidia of both species and it appears that none of the determined solubilities indicates the true availability of the copper in these solutions. One of two copper oxychlorides, despite its relatively high solubility, was only slightly toxic to the conidia of *S. fructicola* and non-toxic to the conidia of *G. cingulata*. The saturated solutions of cuprous oxide (red), basic copper sulphate, one of the

copper oxychlorides, copper maleate, and basic copper maleate were toxic to both species. A saturated solution of copper oxalate was only slightly toxic to *S. fructicola* and innocuous to *G. cingulata* and experiments with diluted concentrations of oxalic acid revealed that this difference was due to the specificity of the acid. The addition of an equivalent amount of malic acid entirely inactivated quantities of ionic copper known to be lethal to the conidia of *S. fructicola* since it appears that the copper malate molecule is not absorbed by the latter. Low concentrations of this acid were assimilated by the conidia of both species, and promoted growth.

The author concludes that the injurious effects of a copper compound on sprayed plants may be determined by its solubility and the fungicidal activities by the degree of ionization in its solution. Most of the materials that are more or less injurious to higher plants appear to have solubilities of the same order as those of alkaline Bordeaux mixtures and few of these are likely to be less injurious than the latter. An ideal copper spray would be one in which the copper ion concentration is high enough to be toxic to fungus spores but not to be seriously phytocidal; this concentration appears to be about 1·0 p.p.m.

FAJANS (E.) & MARTIN (H.). **The incorporation of direct with protective insecticides and fungicides. III. Factors affecting the retention and spray residue of emulsions and combined emulsion-suspensions.**—*J. Pomol.*, xvi, 1, pp. 14–38, 1 pl., 2 graphs, 1938.

Continuing their previous studies [*R.A.M.*, xvi, p. 694], the authors give a fully tabulated account of laboratory and field experiments made to ascertain the physico-chemical properties which determine retentiveness and tenacity of the deposit in sprays consisting of penetrant emulsions (liquid/liquid systems) and of added suspensions (liquid/liquid/solid systems).

BARY (P.) & CORNU (C.). **Sur un nouveau mode de préparation des solutions colloïdales employées contre les parasites des plantes.** [On a new mode of preparation of the colloidal solutions used against plant parasites.]—*C.R. Acad. Agric. Fr.*, xxiv, 7, pp. 304–307, 1938.

Directions are given for a simple method of preparing colloidal solutions of standard fungicides for immediate use. The total quantity of liquid required is equally divided in two vessels, which are so placed that their contents flow straight into the hose of the spraying apparatus where the two solutions, e.g., of copper sulphate and sodium carbonate, mix and are immediately projected on to the leaves and fruits to be treated. The spray is free from aggregations of insoluble matter, and is evenly dispersed over the plant surface in the form of a light deposit.

JAMALAINEN (E. A.). **Kasvinsuojeluaineiden tarkastus Tanskassa ja Saksassa.** [The testing of plant protectives in Denmark and Germany.]—*Valt. Maatalousk. Julk.*, 97, 32 pp., 2 figs., 1938. [German summary.]

With a view to the introduction into Finland of an official system of testing plant protectives, the writer investigated the organization of

this branch of phytopathology in Denmark [*R.A.M.*, xvii, p. 332] and Germany [ibid., xvii, p. 51] in 1937 and here summarizes the results of his observations, on the basis of which he concludes that the methods employed in either of these countries might equally well serve as a model for a Finnish service on similar lines.

YOUNG (E. L.). **Labyrinthula on Pacific Coast Eel-Grass.**—*Canad. J. Res.*, Sect. C, xvi, 3, pp. 115–117, 1938.

Zostera marina collected off the coast of British Columbia in September, 1936, and July, 1937, was found to be infected with a *Labyrinthula* [*R.A.M.*, xvi, p. 698] apparently identical with the organism found on the grass in Atlantic waters and identified by the author as *L. macrocystis* Cienkowski. The macroscopic and histological appearance of the infected grass also appeared to be identical with the condition of the affected Atlantic grass.

LOCKWOOD (L. B.) & MOYER (A. J.). **The production of chemicals by filamentous fungi.**—*Bot. Rev.*, iv, 3, pp. 140–164, 1938.

In this survey the authors, after a brief introductory discussion of industrial processes utilizing moulds, give a short description of the three basic types of apparatus used in industrial fermentation, viz., shallow pans, deep vats, and rotating drums, indicate the procedure generally adopted, and then discuss a number of products obtained from fungi. A bibliography of 173 titles is appended.

BLATTNÝ [C.]. **Poznámka o méně známých virových chorobách.** [Note on some less known virus diseases.]—*Ochr. Rost.*, xiv, 55, pp. 86–87, 1938. [German summary on p. 99.]

This is a very briefly annotated list of relatively little known virus diseases of various plants stated to have been observed in Czechoslovakia, namely: vein mosaic of the dog rose (*Rosa canina*), small-leaved birches, and aspen; interveinal mosaic of birch; and mottled mosaic of the elm and horse chestnut. Ring spot mosaic of plums is not frequent, but it was found to be sometimes latent in myrobalan [*Prunus divaricata*] stocks, the symptoms later developing in the plums grafted on them. Hops are attacked by streak and ring spot mosaics, the first of which is transmissible both by sap and by grafts, but usually only occurs on very old hop plants, and the second, only transmissible by sap, is of a transient nature and does not apparently affect the yield. Cultivated iris plants not infrequently exhibit symptoms resembling 'breaking' in tulips [*R.A.M.*, xvii, p. 459], associated with defective or belated development of the flowers.

STANLEY (W. M.). **The biophysics and biochemistry of viruses.**—*J. appl. Phys.* (formerly *Physics*), ix, 3, pp. 148–155, 2 figs., 1938.

Among the items of phytopathological interest in this critical survey of the biophysical and biochemical aspects of viruses, already largely covered by earlier notices in this *Review*, the following may be mentioned. The sedimentation constants of the heavy proteins isolated by Wyckoff by differential ultracentrifugation from Turkish tobacco plants infected by the latent mosaic of potato, tobacco ring spot, severe etch,

and cucumber mosaic viruses were found to be 113, 110, 180, and 120, respectively. These heavy proteins were found to possess the properties of their respective viruses. Whereas normal tobacco plants contain no demonstrable heavy protein, the virus protein content of those suffering from mosaic is estimated at 400 mg. per 200 gm. plant tissue, or about one part of protein per 500 parts of tissue. Loring has found, however, that virus-diseased tomato and spinach plants contain, respectively, only 260 and 30 mg. These disparities may possibly be significant as indicating that the level reached by the virus protein in different plants depends on a characteristic individual mechanism. The amount of virus protein in a given host also varies with the particular strain of the virus, that of aucuba mosaic in tobacco amounting to only 350 and the masked strain to 200 mg. as compared with 400 for ordinary mosaic.

The density of the tobacco mosaic virus protein has been shown by fractional crystallization to be 1·33, or substantially higher than the value (1·1) usually quoted for bacteria. The viscosity of tobacco mosaic virus protein solutions has been found to lie between that of gelatine and egg albumin, and is thus considerably less than that of myosin. The molecules of the protein are probably not thread-like, but are of the order of, say, ten times as long as their cross-section.

STANLEY (W. M.). **The reproduction of virus proteins.**—*Amer. Nat.*, lxxii, 739, pp. 110–123, 1 fig., 1938.

In this address, read at a symposium of the American Society of Naturalists, December, 1937, the author discusses certain aspects of virus studies in relation to the nature of protoplasm and arrives at the conclusion that, although the physical and chemical properties of tobacco mosaic virus protein seem to indicate that it is a molecule [*R.A.M.*, xvii, p. 407 and preceding abstract], it has, in addition to the ordinary properties of molecules, the ability to reproduce and to mutate and that therefore it represents an entity hitherto unknown. Assuming that the virus protein may be built up from smaller serologically inactive units and that the living cell contains all the component parts, the author suggests, as a matter of speculation, that the virus protein molecule introduced into a living cell may be able to cause these component parts to line up in an orderly fashion according to the pattern of the virus protein, in a similar way as a crystal causes the crystallization of substances when introduced into a saturated solution.

ALLINGTON (W. B.). **The separation of plant viruses by chemical inactivation.**—*Science*, N.S., lxxxvii, 2255, p. 263, 1938.

The author accomplished the separation of mixed viruses of cucumber mosaic and potato ring spot by adding potassium permanganate at concentrations varying from 0·1 to 0·9 per cent. to the mixtures, when (except in one experiment) only the potato ring spot virus survived. Lithium carbonate (1 per cent.) and copper sulphate (2 per cent.) gave similar results. By treatment of the mixed viruses with silver nitrate (0·1 to 0·5 per cent.) or mercuric chloride (0·1 to 0·9 per cent.), the potato ring spot virus was inactivated leaving only the cucumber mosaic virus infective. The chemicals were added to the virus extracts

and allowed to act at 20° C. for one hour. After diluting these preparations to 1 in 50, inoculations were made on Havana tobacco, and if symptoms caused by only one virus were apparent, extracts from such plants were tested for purity by further inoculations into tobacco.

RAWLINS (T. E.) & TAKAHASHI (W. N.). **The nature of viruses.**—*Science*, N.S., lxxxvii, 2255, pp. 255–256, 1938.

The authors discuss the recent experimental results obtained by various workers which appear to be evidence for the animate nature of viruses. Comparing the reports by F. Miescher (1896), W. J. Schmidt (1928), and F. Rinne (*Trans. Faraday Soc.*, xxix, p. 1016, 1933), stating that a large proportion of the material in the heads of certain sperms is a doubly refractive nucleoprotein, and that the X-ray analysis of these sperms indicates that this material is in a liquid crystalline state, with the reports by other workers stating that the purified tobacco mosaic virus protein shows double refraction and the same X-ray pattern, the present authors conclude that the tobacco mosaic virus may possibly be a submicroscopic, elongated organism composed largely or entirely of liquid crystalline nucleoprotein and that the double refraction is produced by the tendency of this organism to become orientated by streaming or standing. Referring to the bacterium-shaped virus particles photographed by J. E. Barnard by the use of ultra-violet light [*R.A.M.*, iv, p. 687], the authors state that these, like tobacco mosaic virus nucleoprotein and the nucleoprotein in chromosomes, have been reported to show high absorption of wave-lengths in the neighbourhood of 2,570 Å, and they suggest that all three materials may possibly have a somewhat similar composition. Furthermore, Bawden and Pirie [see below, p. 564] have shown that tobacco mosaic is not appreciably hydrolysed by proteolytic enzymes until the virus is inactivated by heating, and this behaviour toward enzymes is similar to that shown by organisms.

FRANKE (H. M.). **Zur Physiologie der pflanzlichen Virose.** [On the physiology of the plant viruses.]—*Biochem. Z.*, ccxcvi, 1–2, pp. 149–152, 1938.

G. A. Kausche's recent report of his studies on the X and Y viruses of potato [*R.A.M.*, xvii, p. 265] contained various criticisms of the analytical methods used by the writer in his investigations on tobacco mosaic [ibid., xvii, p. 129]. The objections are briefly discussed and explanations given for the particular technique employed, especially with reference to the acid titration of the expressed juice. Extreme caution is indicated in the comparative interpretation of the analytical data secured in the study of such widely divergent virus groups as those represented on the one hand by tobacco mosaic, and on the other by the X and Y viruses of potato.

VERGE (J.). **Les ultra-virus.** [The ultra-viruses.]—*Rec. Méd. vét.*, cxiii, 11, pp. 653–679, 1937.

This is a critical, thoroughly documented study of the ultramicroscopic virus diseases of man, animals, and plants, comprising sections on the history of the viruses; their nomenclature and hosts; physical,

chemical, biological, and physiological properties; saprophytic ultramicroscopic viruses; classification; and origin and nature of ultramicroscopic viruses.

VIERHAPPER (F.). **Neuere Ergebnisse chemischer Virusforschung.** [Recent results of chemical virus research.]—*Öst. ChemZtg*, xli, 6, pp. 118–123, 2 figs., 1938.

This is a critical discussion of some outstanding recent contributions to the chemistry of plant and animal viruses, most of which have been noticed from time to time in this *Review*.

THORNBERRY (H. H.). **Pectase activity of certain micro-organisms.**—*Phytopathology*, xxviii, 3, pp. 202–205, 1938.

According to Neuberg and Ostendorf (*Biochem. Z.*, ccxxix, p. 464, 1930), extracts from pectase-active plant tissues hydrolyse the ester linkage of the half calcium salt of monomethyl tartaric acid. The ester being water-soluble and hydrolysable by pectase into soluble methyl alcohol and insoluble half calcium salt of tartaric acid, this method of determining pectase activity offers promise of utility for quantitative measurements based upon the precipitate formed. The present paper deals with the data obtained at the Kentucky Agricultural Experiment Station from the determination by this method of the pectase activity of certain plant pathogens [*R.A.M.*, vii, p. 192; xiii, p. 530] and of an extract of cured tobacco leaves.

The organisms, comprising eight strains of *Fusarium* sp. from tobacco stems, two of *Sclerotium bataticola* [*Macrophomina phaseoli*: ibid., xvii, p. 115], *Sclerotinia sclerotiorum*, *S. trifoliorum* [ibid., xvii, p. 235], *Rhizoctonia* sp. from tobacco, three strains of *Thielaviopsis basicola* [see below, p. 560], *Phytomonas* [*Bacterium*] *mori* [*R.A.M.*, xvi, p. 785], *P. tabaca* [*Bact. tabacum*], and *P. angulata* [*Bact. angulatum*: ibid., xvii, p. 353], were grown for five days at 37° C. in 100 ml. nutrient broth containing 10 per cent. commercial pectin, adjusted to a reaction of P_H 8·5 in 0·1 molar phosphate buffer, and passed through filter-paper. The mycelial mass of fungal pathogens in the residue and 25 gm. of cured tobacco leaves were macerated separately and extracted in 100 ml. molar phosphate buffer at P_H 8·5 for six hours at room temperature. The enzymes in the filtrates from these extractions and the filtrate from the culture fluids were precipitated by alcohol and the dried precipitate was extracted in 2 ml. 0·1 molar phosphate buffer at P_H 8·5, and filtered, the clear filtrate being used immediately as the preparation of pectase. Five ml. of a 10 per cent. aqueous solution of the crude syrup of the ester, adjusted to P_H 6·5 in an acetate buffer, was added to the pectase preparations. On mixing the liquids and adding 0·5 ml. toluol, the solutions were incubated at 37° for 1 to 5 days. A precipitate in the tubes indicated hydrolysis, which is considered to represent pectase activity.

Freshly isolated cultures of *F.* sp. gave moderate hydrolysis, whereas little or no activity was shown by those that had undergone repeated subculturing since removal from their host. *S. sclerotiorum* and *S. trifoliorum* were only slightly active, but considerable hydrolysis took place in the tubes inoculated with *M. phaseoli*. The tobacco *Rhizoctonia* gave negative results, while those obtained with *T. basicola* were variable.

In inoculation tests on tobacco with a culture of the latter fungus showing fair pectase activity, E. M. Johnson (unpublished data) induced severe black root rot, whereas another less active culture caused milder symptoms. Cured tobacco-leaf extracts possessed a fair amount of activity.

Murphy (P. A.). **The leaf roll disease of Potatoes: a summary of modern knowledge.**—*J. Dep. Agric., Eire,* xxxv, 1, pp. 1–19, 4 pl., 1 fig., 1938.

In this paper the author gives a full review of the information at present available on potato leaf roll [*R.A.M.*, xvii, p. 479], with special reference to conditions in Eire.

Davidson (W. D.). **Rainfall and seed Potatoes.**—*J. Dep. Agric., Eire,* xxxv, 1, pp. 20–24, 1938.

In this paper the author adduces reasons in support of the view that the best localities in Eire for growing seed potatoes are those with a cool, moist climate and a high rainfall well distributed throughout the growing season. During the three abnormally dry summer seasons of 1932 to 1934 there was an unusual spread of leaf roll [see preceding abstract] with a corresponding loss of vigour in areas on the east coast having a low rainfall, though in the much wetter parts in the west, south-west, and north-west the disease was very rare. In recent years it has been easier to keep stocks vigorous and free from leaf roll in County Cork, where the rainfall is comparatively high, than in Louth, where it is much lower, and the atmosphere is drier and colder. The superiority of mountain seed is probably due to the heavier rainfall on the higher ground.

The test of the suitability of a district for potato seed production is its capacity to preserve the vigour of stocks for very long periods without a change of seed.

The Pink Eyes variety has been grown in Galway since 1795; the Lumper, grown since 1808 in the Dingle peninsula, Kerry, was still found there in 1930; the White Rick variety has been grown in Donegal since before 1840; and Early Rose on the Athlone bog lands since 1867. In none of these cases has there been a change of seed within living memory. Soils (if not waterlogged) which retain a considerable amount of water appear to be superior for seed potato-growing to light, sandy soils. Vigour cannot be due to coldness, as the mild west coast of Eire produces better potato seed than the colder east coast. Investigations by Maldwyn Davies in Wales have shown that *Myzus persicae* is very inactive under moist or windy conditions, and very active in calm, sunny weather, and this explains the retention of vigour by potatoes in regions of high rainfall.

Friedrich (H.). **Uber die Spaltöffnungsweiten blattrollkranker Kartoffelpflanzen. Untersuchungen mit der Infiltrationsmethode.** [On the width of the stomatal apertures in Potato plants affected with leaf roll. Investigations by the infiltration method.]—*Angew. Bot.*, xx, 2, pp. 129–155, 1 fig., 5 diags., 1938.

The author points out that, in spite of certain improvements

introduced by him into the infiltration method of measuring the width of the stomatal aperture, the results obtained are admittedly open to criticism on account of errors inseparable from the method, but nevertheless he regards them as in all probability correct, especially as they agree with those obtained by other workers using different methods. In the course of field experiments leaflets picked from 18 different potato varieties, both healthy and affected with leaf roll [*R.A.M.*, xvii, p. 338 and preceding abstracts], were dipped in xylol, turpentine, turpentine plus castor oil, or alcohol, withdrawn at once and carefully examined, any degree of penetration of the liquid into the leaf being recorded as infiltration. Care must be taken to carry out the whole range of experiments under uniform weather conditions and if possible in full sunshine, since all the 18 varieties exhibited practically the same degree of infiltration under uniform conditions but showed increased infiltration at high moisture contents of soil and air. The results of 25 experiments involving the testing of 750 leaves showed that in the case of healthy plants xylol invaded 87 per cent. of the leaflets, turpentine 83 per cent., turpentine + castor oil 67 per cent., and alcohol 43 per cent., the corresponding percentages for diseased plants being 50, 50, 33, and 20. It is believed, therefore, that the stomatal apertures of leaf roll diseased plants are more nearly closed than those of healthy plants. This may be explained, on the basis of Stålfelt's hypothesis (*Planta*, viii, p. 287, 1929), by the increased turgor of the cells of the epidermis due to the increased production of starch and glucose in the diseased leaf.

Gigante (R.). **Esperienze sulla trasmissibilità della 'necrosi del cuore' dei tuberi di Patata.** [Experiments on the transmissibility of 'heart necrosis' of Potato tubers.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 3, pp. 277–292, 4 figs., 1937 [issued March, 1938].

Further investigations carried out in Italy into potato heart necrosis [*R.A.M.*, xv, p. 458; xvii, p. 410] showed that the disease is transmitted from diseased plants to the next generation by both affected and apparently sound tubers. Continued reproduction of diseased tubers aggravates the disease and greatly reduces the yield. No transmission occurs when healthy potato plants are inoculated with juice from, or grafted with, parts from plants grown from diseased tubers. Tomato, chilli, eggplant, and tobacco plants similarly treated also remained unaffected. When healthy tubers of Böhm's Allerfrüheste Gelbe, Noordeling, and Paul Krüger [President] potatoes were inoculated with pieces from diseased tubers of Böhm's variety, the only variety to become affected was President, which showed 2 per cent. infection. When healthy Böhm's tubers were inoculated with juice from affected and apparently healthy tubers of the same variety, 3 per cent. and 2 per cent., respectively, of the daughter tubers became affected. It is concluded that the disease is due to a virus and is in some respects analogous to 'Eisenfleckigkeit' [loc. cit.].

Scott (R. J.). **Mosaic diseases of the Potato.**—*Scot. J. Agric.*, xxi, 2, pp. 121–132, 1938.

Recent improvements in the potato scheme of the Department of Agriculture for Scotland include the inspection of all stocks for health

as well as for purity, there being over 50,000 acres inspected annually. The certificates awarded in 1937 were as follows: (1) Stock Seed to crops which were 99·95 per cent. pure and practically healthy apart from negligible mottle; (2) T.S. (A.) (immune varieties) and N.I. (A) (non-immune varieties) to crops which were 99·5 per cent. pure and contained not more than 1 per cent. total of mild mosaic, severe mosaic, leaf roll, and wildings; (3) T.S. (H) and N.I. (H.) to crops which were 99·5 per cent. pure and contained not more than 3 per cent. of severe mosaic, leaf roll, and wildings. B reports were issued for crops which were 97 per cent. pure and contained not more than 3 per cent. of severe mosaic, leaf roll, and wildings. For instructional purposes five arbitrary grades of mosaic have been recognized, (1) negligible mottle, which can only be seen by careful examination and is possibly not even visible in sunshine; (2) borderline mild mosaic, which is an overlapping of the negligible mottle and mild mosaic; (3) mild mosaic showing mottling visible at a distance of two to three paces and not obscured in sunshine but causing no reduction in size of plant or distortion of leaf surface; (4) borderline severe mosaic showing very obvious mottling and possibly slight distortion of leaf and very slight reduction in size of plant; (5) severe mosaic causing substantial reduction in size of plant and distinct distortion and mottling of leaf. In the actual inspection scheme these grades are condensed into three, the two borderline sections being dispensed with.

The author gives a tabulated analysis of viruses and virus combinations present in each grade of disease, much of which has already been noticed [*R.A.M.*, xvii, p. 374]. Potato varieties can be classified according to virus content into three classes: (*a*) virus-free varieties, e.g., Majestic, (*b*) varieties invariably infected with virus X, e.g., Up-to-Date, and (*c*) varieties invariably infected with virus A, e.g., Golden Wonder, and it is suggested that the breakdown of healthy stocks would be avoided by growing varieties of one class only; but as this is impracticable, growers are advised to grow varieties from different classes widely separated by a minimum distance of 50 yds., and those of the same class with sufficient isolation to avoid mixing. Virus Y is not considered in the scheme, since it is comparatively rare in Scotland and probably already entirely eradicated by growers, who have been growing crops of stock seed standard for a number of years.

KÖHLER (E.). **'Mutationen' bei pflanzenpathogenen Viren. (Sammelreferat.)** ['Mutations' in plant-pathogenic viruses. (A symposium.)] —*Züchter*, x, 3, pp. 68–72, 1 fig., 1938.

All the work on which the writer bases his concise survey of the phenomenon of mutation in some well-known plant-pathogenic viruses has been noticed from time to time in this *Review*.

STARÝ (B.). **Elektrometrické hodnocení sadbové hodnoty Bramborových hlíz pomocí redoxpotenciálu.** [Electrometrical determination of the seed value of Potato tubers by means of the reduction-oxidation potential.]—*Ochr. Rost.*, xiv, 55, pp. 53–55, 1938. [German summary.]

In giving a brief account of experiments conducted to check

Wartenberg and Hey's electrometric method [*R.A.M.*, xvii, p. 341] of determining the freedom or otherwise of potato seed tubers from virus diseases, the author states that departing from the German method he compared the positive, as against the negative, values of the reduction-oxidation potential in healthy and in diseased tubers, one-half of which was used for the tests and the other was planted for control purposes. The results of tests with several potato varieties showed that in the pulped tissues of diseased tubers the potential varied between 200 and 520 millivolts, and that in those of healthy tubers it varied between 100 and 350 millivolts, i.e., that the lower the potential the higher is the seed value of the tubers. A weak point of the method is the overlapping to the fluctuation limits, which, taken together with the delicate nature of the tests, tends to limit its usefulness for the determination of the health of seed tubers.

Straňák [F.], Blattný [C.], Starý [B.], Novák, Robek, & Nolč. **Poznámky k methodě Glynne-Lemmerzahlově o zjišťováni náchylnosti odrůd Bramborů vůči rakovině.** [Observations on the Glynne-Lemmerzahl method for the determination of the susceptibility of Potato varieties to wart disease.]—*Ochr. Rost.*, xiv, 55, pp. 91–94, 1 fig., 1938. [German summary on p. 101.]

The authors state that in 1937 they tested over 800 potato varieties and hybrid seedlings for wart disease (*Synchytrium endobioticum*) both in the laboratory by the Glynne-Lemmerzahl method [*R.A.M.*, x, p. 403; xv, p. 524] and in the field, the results showing up to 95 per cent. agreement in the two parallel series. The laboratory method, however, is much more severe than the field tests and is particularly useful in eliminating susceptible hybrid seedlings, but for practical purposes maintained field resistance is sufficient, even when the other method does give indications of slight susceptibility. The formation on the potato organs of abortive infections is not, as held by certain investigators [loc. cit.], an indication of wart disease resistance, since it also occurs in very susceptible seedling varieties. It is further stated that certain English and German potato varieties, described as immune, and many wild potato species gave indications of susceptibility in laboratory tests.

Grünfeld (O.). **Ein Jahrfünft Kartoffelkrebsversuche der Liebwerder Station für Pflanzenschutz in Schluckenau. (Eine vorläufige Übersicht aus der Station für Pflanzenschutz.)** [Five years' Potato wart disease tests at the Liebwerd Plant Protection Station in Schluckenau. (A preliminary review by the Plant Protection Station.)]—*Ochr. Rost.*, xiv, 55, pp. 70–74, 1938. [Czech summary.]

After describing the procedure adopted in potato tests for resistance to wart disease [*Synchytrium endobioticum*] at the Tetschen-Liebwerd Plant Protection Station near Prague, the author gives a preliminary list of potato varieties which in experiments from 1933 to 1937 have been found to be completely immune from the disease both in the laboratory and in the field, namely: Modrow's Aal and Blaupunkt; Böhm's Ackersegen, Mittelfrühe, Ovale, and Ovalgelbe; Veenhuizen's Alberta; P.S.G.'s Cellini, Flava, Fram, and Tiefgelbe Rote; Paulsen's Estimata

and Juli; Zwehl's Feldglück and Feldsonne; Müller's Fredanna; Ebsdorfer's Juli; Kameke's Parnassia and Robinia; Deutschbroder's Nieren and Viktoria; Lembke's Edda; Alpha, Altgold, Betula, Edelragis, Ragis, Frieso, Frühgold, Furore, Goldball, Goldfink, Goldwährung, Havilla, Hellena, Ideal, Integra, Isolde, Maibutter, Mela, Kerkauer Nieren, Nordost Stärkereiche, Nordost Goldgelbe, Ostbote, Parnassia Valečovská, Parnassia Kerkovska, Kerr's Pink, Preussen, Quitte, Sazavky, Sickingen, Treff As, Vera, and Voran. Paulsen's Roland needs further testing, as a few tubers showed traces of infection in the laboratory.

Verzeichnis der krebsfesten Kartoffelsorten im Sinne der Verordnung zur Bekämpfung des Kartoffelkrebses vom 8 Oktober 1937. [List of wart-immune Potato varieties in the sense of the Order for Potato wart control of 8th October, 1937.]—*NachrBl. dtsch. PflSchDienst*, xviii, 3, p. 21, 1938.

In pursuance of an Order of 8th October, 1937, aiming at the gradual elimination of potato wart [*Synchytrium endobioticum*] from the German Reich [cf. *R.A.M.*, xvii, p. 208], lists are given of 40 varieties admitted to unrestricted cultivation, 26 of which may be grown conditionally, 5 allowed to be cultivated for seed certification for the last time in 1938, and 93 no longer to be placed on the market for seed purposes.

Sukhorukoff (I.), Kling (E.), & Ovčarov [Ovtcharoff] (K.). **The effects of Phytophthora infestans de Bary on the ferments of affected plants.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xviii, 8, pp. 597–602, 1938.

Referring to Lepik's work [*R.A.M.*, viii, p. 596], the results of which appear to indicate that *Phytophthora infestans* is able to use the starch in potato tubers infected by it, the authors state that in their own aseptically conducted experiments the fungus consistently failed to grow in media containing starch as the source of carbon in the absence of extraneous diastase, and that its mycelium was shown by biochemical tests not to contain amylase. They further refer to investigations in 1923 by Haehn and Schweigart, who found that the activity of amylase in potato tubers is very low, a fact which was confirmed by them. The authors claim to have established by special tests [some details of which are given] that potato foliage and tubers contain a substance inhibiting amylolytic reactions, which they tentatively identify with sistoamylase, described in 1933 by Chrzaszcz and Janicki [Janitzki] as existing in the seeds and shoots of buckwheat and cereals. Further determinations showed that the amount of sistoamylase is considerably greater in varieties (*Solanum demissum* and 8670 JKH) immune from or highly resistant to *P. infestans* than in Early Rose, which is very susceptible; the quantity is not constant, however, in potato tubers, but undergoes noticeable changes during the resting period. In yet another series of experiments it was found that in developing on potato (Lorch) tubers the fungus gradually reduced their content of sistoamylase, a peculiarity which is believed to play a prominent part in its biology and in its pathogenicity to the potato. By lowering the content of the potato plant in sistoamylase, which is stated to hinder the development of other micro-organisms, it renders the potato tubers accessible to secondary putrefactive organisms.

LEHMANN (H.). **Geschichte und Ergebnisse der Versuche zur Züchtung krautfäulewiderstandsfähiger Kartoffeln.** [History and results of experiments in the breeding of late blight-resistant Potatoes.]—*Züchter*, x, 3, pp. 72–80, 1938.

The writer outlines the history of potato-breeding for resistance to late blight (*Phytophthora infestans*) and summarizes the results of some outstanding contributions towards the solution of the problem, most of which have been noticed from time to time in this *Review*.

NATTRASS (R. M.). **Note on two diseases of Potato tubers.**—*Cyprus agric. J.*, xxxiii, 1, pp. 4–6, 4 figs., 1938.

Potatoes in Cyprus have recently become infected by *Alternaria solani* [*R.A.M.*, xvi, p. 20] and *Macrophomina phaseoli* [ibid., xi, p. 126]. The presence of either disease leads to the rejection by the official inspection service of potatoes consigned for export. Control of *A. solani* consists in spraying in the early stages of foliage infection with Bordeaux mixture or other protective copper fungicide. *M. phaseoli* produces circular or oval black spots, 2 to 3 mm. in diameter, the centre of each being raised, lighter in colour than the surrounding tissue, and showing broken skin. The outline of the smaller spots is distinct, while that of the larger ones is diffuse. When close enough together the spots form a larger lesion of indefinite outline. The diseased tissue extends to a depth of about 2 mm. only. In the larger spots there is an air space between the skin and the top of the diseased tissue which becomes black and dry, the flesh of the tuber after cutting also quickly turning black; such tubers rapidly rot in storage. The fungus appears to enter the tubers through the lenticels. It is a common soil-inhabiting organism in Cyprus, and is spread by tools and irrigation water. All affected plants, potatoes and others, should be uprooted and destroyed.

ORTON (C. R.) & HILL (L. M.). **Further observations on 'blue stem' of Potato.**—*Amer. Potato J.*, xv, 3, pp. 72–77, 1 fig., 1 diag., 1938.

Further observations and experiments in connexion with the widely distributed disease of potatoes, referred to as 'blue stem' in West Virginia [*R.A.M.*, xvi, p. 831] and Pennsylvania, clearly point to the probable association of the trouble with insect infestation; the implication of bacteria or fungi would appear to be definitely excluded by the negative results of extensive isolation and inoculation experiments.

FUKUSHI (T.). **An insect vector of the dwarf disease of Rice plant.**—*Proc. imp. Acad. Japan*, xiii, 8, pp. 328–331, 1 fig., 1937.

The author's studies during 1936–7 at Horigome confirmed the conclusion reached by Takata, more than 40 years ago, that *Deltocephalus dorsalis* Motsch. was a vector of the dwarf disease of rice [*R.A.M.*, xvi, p. 485]. The symptoms transmitted by its agency were entirely identical with those transmitted by *Nephotettix apicalis* Motsch. var. *cincticeps* Uhl., generally believed in Japan to be the sole vector of the disease. Of 112 leafhoppers tested in 1936, 45 killed the rice plants, and of the remainder only one produced infection on 21 of 25 plants exposed to its feeding for one day. In the series of experiments during 1937 about

40 per cent. of the leafhoppers killed the plants, and 17 insects produced infections. In both years several of the insects produced numerous minute white flecks or stripes along the leaf veins, a symptom resembling that of dwarf disease at an early stage of its development, but confined to the leaves actually affected by the insects, while subsequent new growth remained healthy.

HARRAR (J. G.). **Factors affecting the pathogenicity of Fomes lignosus Klotzsch.**—*Tech. Bull. Minn. agric. Exp. Sta. 123*, 28 pp., 10 figs., 1937.

The taxonomy of the fungus causing root rot of *Hevea brasiliensis* is not yet finally settled, but the author uses the name *Fomes lignosus* [*R.A.M.*, xvii, p. 484] since it appears to be the most commonly used in recent literature. Cultures from rotted *Hevea* roots from the Firestone rubber plantations in Liberia were used in the present study. The formation of rhizomorphic strands was observed in soil cultures in which nutrient media were incorporated. The hyphae are hyaline, vary from 1·8 to 6·2 μ in diameter, and are characterized by anastomoses and numerous large clamp-connexions. Both bi- and multinucleate cells were present. True spores were not found to develop in culture, but frequently chlamydospore-like organs were formed. The hyphae often possessed long, pointed tips with a subterminal swelling producing spore-like structures which are believed to be resistant to desiccation and other unfavourable conditions. Temperature tests showed that the cultures of the fungus could not live above 36° C. or below 2°, the optimum temperature for growth being about 28°. At the optimum temperature on different media the fungus grew at P_H values from 4 to over 10, the optimum varying according to the medium from P_H 6 to 7·5. Light conditions had little effect on the growth of the fungus in culture, but direct sunlight at 80° F. or excessive ultra-violet light rapidly killed the culture. Fertilizers appeared to have no appreciable effect on the development of the fungus in soil. Of 13 fungicides tested the organic mercury dusts were found to be the most toxic, new improved ceresan at a concentration of 0·001 per cent. being the best.

KALIS (K. P.). **Beknopt overzicht van de Rubber- en Theecultuur in het rayon Bandjar-Tasikmala-Garoet.** [An abridged survey of Rubber and Tea cultivation in Bandjar-Tasikmala-Garoet region.] —*Bergcultures*, xii, 13, pp. 375–380, 1938.

The following items of phytopathological interest occur in this report on *Hevea* rubber and tea cultivation in West Java during 1937. Rubber mildew [*Oidium heveae*: *R.A.M.*, xvii, p. 414] assumed a virulent form, and the outcome of sulphur-dusting experiments was inconclusive and frequently disappointing, especially in respect of the preservation of the fruit for seed. Mouldy rot [*Ceratostomella fimbriata*] was also prevalent.

A correlation was observed between red root rot of tea [*Ganoderma pseudoferreum*: ibid., xvii, p. 202] and the common local practice of felling the *Albizzia* trees, interplanted for shade or manure, at ground-level, which permits the spread of the fungus through the plantation by way of the infected stumps. A high incidence of black root rot [*Rosellinia arcuata* and *R. bunodes*] [loc. cit.], which is commonly observed on late

volcanic soils, was frequently, but not invariably, found to be associated with the presence of dying lamtoro [*Leucaena glauca*].

STARKEY (R. L.). **Some influences of the development of higher plants upon the microorganisms in the soil: VI. Microscopic examination of the rhizosphere.**—*Soil Sci.*, xlv, 3, pp. 207–248, 11 pl., 1938.

Using Cholodny's buried slide technique [*R.A.M.*, xv, p. 334], the writer pursued his investigations in New Jersey, now extending over a considerable period, on the influence of higher plants [represented by eight crop plants] on the micro-organisms of the soil, with particular reference to the rhizosphere. Fungus hyphae were abundant even in fallow soil, and there is no doubt that fungi develop vegetatively even in the absence of appreciable amounts of readily decomposed organic matter. Among the fungi detected were *Fusarium*, (?) *Helminthosporium*, *Alternaria*, *Penicillium*, (?) *Sporotrichum*, and an unidentified organism with spores shaped like six-pointed stars, with a deeply staining central body. The fungal mycelia were observed to be very prone to destruction by bacteria, and their persistence in the soil is not generally of long duration. Very little difference was evident in the response of the micro-organisms to different plants.

MACLACHLAN (J. D.). **A rust of the Pimento tree in Jamaica, B.W.I.**—*Phytopathology*, xxviii, 3, pp. 157–170, 3 figs., 1938.

In this full account of his study on the rust *Puccinia psidii* [*R.A.M.*, xvii, p. 17] attacking pimento (*Pimenta officinalis*) in Jamaica [ibid., xv, p. 742], the author states that *P. psidii* was originally described by Winter (*Hedwigia*, xxiii, p. 164, 1884) on *Psidium pomiferum*, which is regarded as a variety of the common guava, *P. guajava*. The latter has been reported as a host of the rust in Porto Rico, but is apparently immune from the pimento and rose apple (*Eugenia jambos*) strains. The expanding foliage, inflorescences, and succulent young twigs are all attacked, while the new leaves formed to replace the fallen ones in turn become diseased. Under Jamaican conditions the rust is perpetuated by the uredospores; teleutospores were found, but no host for the haploid stage was recognized.

MURPHY (P. A.). **Ireland: first appearance of downy mildew of Hop (Pseudoperonospora humuli).**—*Int. Bull. Pl. Prot.*, xii, 3, pp. 53–54, 1938.

A typical outbreak of downy mildew of hops (*Pseudoperonospora humuli*) occurred on the dried cones of a so-called wild hop in an experimental garden in County Cork, Eire, during the exceptionally wet summer of 1937, this being the first record of the disease for the country. Since the imported plants remained healthy from 1935 to 1937, infection presumably did not originate on this material, but is more likely to have been conveyed from the nearest centre of hop cultivation in England, a distance of some 265 miles.

RHIND (D.), ODELL (F. D.), & SU (U. T.). **Observations on phyllody of Sesamum in Burma.**—*Indian J. agric. Sci.*, vii, 6, pp. 823–840, 3 graphs, 1937. [Received April, 1938.]

Investigations carried out in Burma since 1923 into 'phyllody' or

green flowering disease of sesame [*R.A.M.*, xv, p. 396] failed to demonstrate that the condition is seed-borne, and indicated that if the cause is a virus, it is one not readily transmitted by inoculation. Early sowing gave a high percentage of affected plants, and low rainfall favoured the disease. High susceptibility was associated with white seed coat, unbranched habit, and short life-period. When slightly affected plants produce viable seeds they fail to show a normal onset of dormancy. Affected plants have a higher mineral metabolism than unaffected. In conclusion, the suggestion is made that phyllody may be due to failure of the reproductive phase to progress normally, owing to various environmental factors acting on complex, undetermined genetic groupings, the reproductive tissues returning to the vegetative condition. The possibility that the condition may be due to a virus is not entirely excluded.

ROSENFELD (A. H.). **Some notes on varietal resistance to streak disease in Egypt and Natal.**—*Int. Sug. J.*, xl, 471, pp. 99–100, 1938.

In view of the fact that certain sugar-cane varieties (including P.O.J. 2714, 2725, and 2883 and Co. 281 and 290) are susceptible to streak disease [*R.A.M.*, xvi, pp. 368, 409] in Egypt, but appear to show marked resistance in Natal (where *Cicadulina mbila* is much more common than in Egypt), and this in spite of the fact that Uba and its *sinense* relatives are equally affected in both countries, the author suggests that in Egypt the disease may possibly be transmitted by some insect which is a more efficient vector than *C. mbila* on varieties other than Uba.

INGRAM (J. W.) & SUMMERS (E. M.). **Transmission of Sugarcane mosaic by the green bug (Toxoptera graminum Rond.).**—*J. agric. Res.*, lvi, 7, pp. 537–540, 1938.

In a series of experiments carried out in 1936 the green bug, *Toxoptera graminum*, was found to transmit mosaic from infected sugar-cane plants to 21 out of 172 healthy canes, 30 of the insects being transferred to each healthy plant. One transfer of mosaic to sugar-cane resulted from the use of green bugs taken from crab-grass (*Digitaria sanguinalis*) showing symptoms of mosaic. In parallel tests [*R.A.M.*, xv, p. 744], *Aphis maidis* transmitted the disease to 40 out of 124 healthy sugar-cane plants. The new vector is stated to be generally distributed throughout the world and to cause heavy injury especially to wheat and oats in the Mississippi Valley. The aphid feeds upon various parts of the sugar-cane plant above the ground and is commonly found on numerous other grasses. Although at present it appears to be less important in the field than *A. maidis* and *Hysteroneura setariae* [loc. cit.], the authors consider that it may become more dangerous under favourable conditions.

SĂVULESCU (T.). **Contribution à la connaissance des Macromycètes de Roumanie.** [A contribution to the knowledge of the Macromycetes of Rumania.]—*Anal. Acad. române*, Ser. III, xiii, Mem. 8, 72 pp., 5 pl., 1938.

The author gives an annotated list of 196 species of macrofungi

belonging to 78 genera and 12 families found in Rumania, including 64 species not previously recorded therefrom. A table is also given showing all the species (568) so far recorded from Rumania.

SĂVULESCU (T.) & SĂVULESCU (OLGA). **Uredineae novae Romaniae.** [New Uredineae of Rumania.]—Reprinted from 'Hommage au Professeur E. C. Teodoresco', Bucharest, *1937*, 6 pp., 1 col. pl., 2 figs., 1937. [Received May, 1938.]

Latin diagnoses are given of six species of Uredineae new to the flora of Rumania [cf. *R.A.M.*, xvi, p. 776], one of which is also new to science. *Aecidium teodorescui* n.sp., producing circular spots, 2 to 10 mm. in diameter, on leaves of *Berberis vulgaris* in Bessarabia, is characterized by amphigenous pycnidia, 72 to 100 μ in diameter; hypophyllous, more rarely epiphyllous, often ramicolous, tubular aecidia, numbering 80 to 100, densely disposed in large groups, 0·2 to 1 cm. diam., sometimes also solitary, and then on round, often thickened, reddish-brown spots 2 to 10 mm. diam., 1 mm. high by 180 to 210 μ broad, with a white, recurved, denticulate margin, polyhedral peridial cells, 23 to 30 by 20 to 23 μ, with striate walls, the outer 8 to 10 and the inner 3 to 4 μ in thickness; and polyhedral, angular to globose or ellipsoid, densely verruculose, pale orange aecidiospores, 16·5 to 23 by 14·5 to 18 μ, with an epispore 1·5 to 2 μ in thickness.

A. delphinii-consolidae Hollós (*Math. term. Közl.*, xxxv, pp. 1, 12, 13, 1926) was observed on leaves of *Delphinium consolida* in Muntenia in 1930.

D'OLIVEIRA (B.). **Apontamentos para o estudio do género Fusicladium. III. Frutificação conidial dos Fusicladia dendriticum, pirinum e eriobotryae.** [Indications for the study of the genus *Fusicladium*. III. Conidial fructification of *Fusicladium dendriticum*, *F. pirinum*, and *F. eriobotryae*.]—*Rev. agron., Lisboa*, xxv, 2, pp. 140–164, 6 pl., 1937. [English summary. Received March, 1938.]

Dox's agar plus maltose proved to be the most suitable medium for the study at Lisbon, Portugal, of conidial fructification in *Fusicladium dendriticum* [*Venturia inaequalis*], *F. pirinum* [*V. pirina*], and *F.* [*dendriticum* var.] *eriobotryae* [*R.A.M.*, xv, p. 184], isolated, respectively, from apple, pear, and loquat. Conidia may be produced directly on the vegetative mycelium or on differentiated conidiophores. In *V. pirina* the first conidium is formed terminally on a hypha, or laterally on a protuberance of an intermediate mycelial cell. The conidium remains attached to the conidiophore, which continues to grow so that the originally apical position of the conidium becomes a lateral one. From the tip of the new growth a fresh conidium is produced and the process successively repeated. This type of conidiophore presents great irregularities and resembles *Scolecotrichum* or in certain cases of verticillate development may recall the growth habit of *Arthrinium*.

The conidia of *V. inaequalis*, on the other hand, are invariably produced apically on the conidiophore, and at the production of each conidium a new ring is formed. This is believed to represent the authentic type of *Fusicladium* conidiophore development.

In *F. dendriticum* var. *eriobotryae* the manner of conidiophore growth is intermediate between that of *V. inaequalis* and *V. pirina*, a fact that

may account for previous confusion in the classification of the first-named species.

Conidia may be formed in chains, short and rare in *V. inaequalis* and *V. pirina*, long and abundant in *F. dendriticum* var. *eriobotryae*; in old cultures of the last-named the chains may be branched like those of *Cladosporium* and *Hormodendrum*. Short chains of uniseptate conidia, of the *Bispora* type, were also observed on the three species. The conidial dimensions of *V. inaequalis*, *V. pirina*, and *F. dendriticum* var. *eriobotryae* in nature ranged from 12 to 31 by 6 to 10 (mostly 21 to 23 by 8·5 to 9·5), 15 to 40 by 6 to 10 (21 to 24 by 6 to 10), and 11 to 30 by 6·5 to 10 (18 to 20 by 8 to 9) μ, respectively, the corresponding figures in culture being 13 to 55 by 6 to 10 (18 to 24 by 6·5 to 7·5), 15 to 60 by 6 to 10 (20 to 25 by 7 to 8), and 7 to 58 by 5 to 11 (15 to 20 by 7 to 8) μ, respectively. All three species produced both bi- and pluriseptate conidia, the former (*Napicladium*) type being frequent, the latter (*Helminthosporium* and *Cercospora*) rare.

The cytological processes involved in conidial development in the three species under observation are described.

[The present paper was preceded by two others, (I) dealing with the conidial characters of the three species, and (II) describing the type of germination of the conidia (*Agros*, xix, 1, 13 pp., 1936; *Rev. agron., Lisboa*, xxiv, pp. 20–51, 7 pl., 1936). English summaries are supplied in both instances.]

Goto (K.). **Sclerotium rolfsii Sacc. in perfect stage. V. Inoculation studies with natural strains, basidiospores, single basidiospore isolates, and some F 1–, F 2– and back cross strains obtained by mating.**—*Ann. phytopath. Soc. Japan*, viii, 3–4, pp. 203–220, 2 figs., 1938. [Japanese summary.]

In further studies on *Sclerotium rolfsii* in the *Corticium* stage [*R.A.M.*, xvi, p. 280] the author carried out inoculation tests on broad bean [*Vicia faba*], tobacco, tomato, cucumber, castor bean [*Ricinus communis*], and other seedlings with the strains previously used. Inoculations were made by placing cultures in short glass caps, cut from the bases of test-tubes and filled with onion agar, against the bases of seedlings grown in sand culture, so that the mycelium reached the host directly and was kept apart from the soil microflora.

Pathogenicity is correlated to some extent with the author's grouping of the strains of *S. rolfsii*, viz., group I, forming spores readily; group II, forming spores; group III, forming spores scantily; group IV, non-sporing; and group IV 2, a sub-group of IV. *S. delphinii* [ibid., xvi, p. 204] was used for comparison.

Strains of *S. rolfsii* proper, i.e., groups I and II, were rather weakly virulent; group III rather strongly so, while most of IV and *S. delphinii* were strongly virulent.

Hymenial structures were produced rapidly and abundantly by one strain (R 11) of group I, once each in four experiments by the remaining strains of groups I and II, and not at all by the others. *S. rolfsii* proper produced only fluffy mycelium, or mycelium mixed with not very marked strands, while most of the other strains produced strands and less spreading hyphae.

Strains from single basidiospores of *S. rolfsii* are more weakly pathogenic than the F_1 progeny (secondary strains) derived from mating two primary isolates, and in nature might be innocuous. Among the F_2 strains tested, one obtained by mating a very weak and a moderately weak F_1 strain proved to be more virulent than the original parents.

No infections resulted from inoculations with basidiospores.

NIETHAMMER (ANNELIESE). **Die Gattung Penicillium.** [The genus *Penicillium*.]—*Zbl. Bakt.*, Abt. 2, xcviii, 1–4, pp. 65–76, 12 figs., 1938.

Representatives of the genus *Penicillium* (which the writer, following Thom, subdivides into three groups, *Monoverticillium*, *Asymmetricum*, and *Symmetricum* [*R.A.M.*, ix, p. 410]) were found, in extensive recent studies in Czechoslovakia, to be much more numerous in the soil—probably their original home—than on fleshy fruits and seeds. Some well-known species were isolated from virtually untrodden tracts of stone and rock. A marked tendency to sclerotial or perithecial formation, largely disregarded by previous investigators, was observed among many species, the close similarity between the perfect stages of which points to a close interspecific relationship and may ultimately simplify the work of classification. In this connexion the practice of creating new species on the basis of variations in the normal growth habit is deprecated. The habitual failure of *P.* spp. to attack intact fruits may be attributed to their negligible cellulose- and fat-dissolving properties.

GOIDÀNICH (G.). **Studi sulla microflora fungina della pasta di legno destinata alla fabbricazione della carta.** [Studies on the fungal microflora of wood pulp destined for paper-making.]—*Boll. Staz. Pat. veg. Roma*, N.S., xvii, 3, pp. 305–399, 40 figs.; 4, pp. 405–474, 32 figs., 1937. [Received May, 1938.]

In this detailed though preliminary account of investigations carried out in Italy during a period of more than two years into the fungous staining of stored wood pulp destined for paper-making [cf. *R.A.M.*, xii, p. 545; xv, p. 623; xvi, p. 575], the author states that the method used to isolate and culture the organisms was to remove portions of the material in sterilized aluminium receptacles with a screw top, and afterwards to incubate at 25° C. on 5 per cent. meat extract agar. This technique compared favourably with the other standard methods which were tested.

The fungi most frequently isolated were *Fusarium*, *Stachybotrys*, *Trichoderma*, and *Hormodendrum* spp., and those least frequently *Graphium*, *Ophiostoma*, the Basidiomycetes, and *Phialophora*. Certain fungi found on wood pulp in other countries were not isolated, including *Oidiodendron*, *Discula*, *Pullularia*, and *Spicaria* spp.

The following isolations are new records for the genera concerned: *Monilia sitophila*, *Papularia sphaerosperma*, *P. arundinis*, *Pseudeurotium zonatum*, *Haplosporella vivanii* n.sp., and *Sporocybe borzinii*.

The following new species are recorded [with Latin diagnoses]. *H. vivanii* n.sp. is characterized by pycnidia 600 to 1,100 μ in diameter covered with a weft of very dark, rigid, septate, branched hyphae, 2·5 to 5 μ in diameter. The dark, opaque wall averages 60 to 90 μ and may

reach 150 μ in thickness. The central part of the pycnidium is occupied by a layer of irregularly quadrangular or rectangular cells 12 to 21 μ thick, forming a pseudoparenchymatous tissue, usually hyaline, but sometimes pale rose-violet in parts. The colourless, 1-celled, cylindrical or apically attenuated conidiophores measure 5 to 12 by 4 to 5 μ. The ellipsoidal conidia are constricted at the base and measure 15·8 to 28 (usually 19·8 to 22·7) by 6·4 to 12·1' (usually 9·8 to 10·3) μ. The mycelium consists of dark hyphae 6 to 12 μ in diameter, with marked septa at intervals of 27 to 40 μ. Some of the hyphae are hyaline, with almost invisible septa, and measure 1·5 to 3 μ in diameter.

The genus *Burgoa* G. Goid. (syn. *Papulospora* Preuss (1851) em. Hotson (1912) p.p.) is characterized by a hyaline, branched, nodulose mycelium 'septate at the nodes in the manner of a Hymenomycete'. The lateral, intercalary, or apical conidia (termed bulbils or spore-bulbils) vary in colour and size and are formed from a central nucleus of hyaline, polygonal cells; they are budded off from the mycelial hyphae, or are arranged in a spiral. *B. verzuoliana* n.sp. is characterized by hyaline or slightly flavous, branched, nodulose-septate hyphae measuring 3·5 to 4·7 (rarely up to 17) μ in diameter, and round conidia 60 to 130 (generally 70 to 90) μ in diameter, very black when mature. *B. anomala* (Hots.) G. Goid. n. comb. (syn. *Papulospora anomala* Hots.) differs from *B. verzuoliana* chiefly in the manner of formation of the bulbil; it is transferred to *Burgoa* as it has clamp-connexions.

Hormodendrum chamaleon G. Goid. n.sp. differs from *H. elatum* in that both on natural and agar media the elements composing the fructifications readily become detached. The conidiophores are dark at the base, light at the extremity, measure 210 to 420 by 4 to 7 μ, with septa at intervals of 27 to 36 μ; the 1-celled ramoconidia measure 8 to 11 by 3·5 to 4·5 μ, the 2-celled measure 15 to 32 by 3·5 to 4·8 μ, and the conidia measure 5·6 to 8 by 2·8 to 3·5 μ.

Phialophora lignicola (Nannf.) G. Goid. n. comb. (syn. *Lecytophora lignicola* Nannf.) [ibid., xiv, p. 275] is the most characteristic species of its genus. The conidia arise from conidiogenes of different types, of which some are 1-celled, cylindrical, with enlarged extremities and measure 2·5 to 4·8 by 1·8 to 2 μ, while others are phial-shaped, being much swollen and short-necked; both forms are sometimes found attached side by side to the same hypha. A third type of conidiogene is phial-shaped, sessile, or pedicellate, 4·8 to 8·5 μ long, and with a small spore-opening at the distal extremity. The mycelium is generally formed of dark, septate hyphae with smooth parallel walls and 1·8 to 3·6 μ in diameter. Often both the aerial and immersed hyphae show spherical protuberances 5 to 8·3 μ thick, with a thickened wall, generally attached to one another in toruloid, simple, rectilinear, or branched chains up to 120 μ long and capable of producing conidia.

Epicoccum mezzettii n.sp. is characterized by reddish-brown, spherical, pedicillate conidia uniformly 9 to 11 μ in diameter.

Sporocybe borzinii n.sp. is characterized by rectangular, hyaline or light brown conidia measuring 9 to 12 by 3 to 5 μ. Two metagenetic stages occur, one belonging to *Sporotrichum*, with oval or piriform hyaline, usually brown conidia measuring 7 to 10 by 5 to 6 μ, the other approaching *Epidochium*.

Berkeley (G. H.). **Diseases of Tobacco—and their control.**—*Canad. Hort.*, lxi, 3, pp. 65–66; 4, pp. 108–109, 4 figs. (1 on p. 64), 1938.

The following items, in addition to those already noticed from another source [*R.A.M.*, xvi, pp. 636, 637], occur in this popular account of Canadian tobacco diseases. Recent studies at St. Catharines, Ontario, have revealed the existence of several strains of the tobacco mosaic virus, some of which tend more strongly than others to cause 'breakdown' (more or less extensive necrosis) of the foliage, especially the lower leaves.

Some degree of resistance to black root rot [*Thielaviopsis basicola*: ibid., xvii, p. 418] has been shown by Harrow Velvet, Kentucky White Burley, Halley's Special, Station Standup, Standup Resistant, Resistant Havana 142, Havana 142 c–3–x, Havana 236 (Johnson), and Grand Rouge No. 4. During 1937 this disease was severe on Burleys in Essex and Kent Counties, Ontario, due to the exceptionally heavy rains, but was virtually absent in Quebec, where unusually dry conditions prevailed.

Brown root rot [ibid., xvi, p. 67] in Ontario generally affects tobacco crops following maize, soy-beans, or timothy [*Phleum pratense*]. Kelley and Judy's Pride have recently been found to show greater resistance than Harrow Velvet, Halley's Special, Kentucky White Burley, Gay's Yellow, and other Burleys, while among the flue-cured varieties White Mammoth, Bonanza, and Duquesne appear to be less liable to the disease than Yellow Mammoth, White Stem Willow Leaf, Adcock, Jamaica Wrapper, and others.

Several cases of frenching [ibid., xvi, p. 637] were observed both in the seed-bed and field in Quebec and Ontario in 1936 and 1937. The disorder is frequently severe on light soils cropped to tobacco for the first time.

A circular, brown, later nearly white spotting of the leaves, chiefly of flue-cured varieties, common in both provinces, is tentatively attributed to a disturbance in the nitrogen-potassium balance of the soil.

Caldwell (J.) & James (A. L.). **The propagation of Tobacco plants from root cuttings.**—*Phytopathology*, xxviii, 3, pp. 229–230, 1 fig., 1938.

Evidence is briefly adduced to show that mosaic tobacco plants (Virginian variety) can readily propagate themselves by means of root cuttings, and that, at any rate under the mild climatic conditions prevailing at Exeter [New Hampshire], they may constitute an important source of infection for the next season's crop.

Valleau (W. D.) & Johnson (E. M.). **Tobacco mosaic. Sources of infection and control.**—*Bull. Ky agric. Exp. Sta.* 376, pp. 221–262, 1 graph, 1937.

The authors sum up the results of their own and other workers' experiments and observations on the sources of initial infection by tobacco mosaic [*R.A.M.*, xvi, p. 658 and preceding abstract] and arrive at the conclusion that the most common cause of plant bed and field infection is the handling of plants by workers, whose hands have become contaminated with the highly viruliferous air- and fire-cured tobacco

used for smoking and chewing. Even the manufactured tobacco, which contains little or no virus, is stated to be not entirely safe for use during weeding. The presence of infected perennial Solanaceous weeds and of aphids and possibly other sucking and biting insects are considered to be possible but minor sources of infection. Little evidence appears to exist as to the occurrence of initial infection through contaminated soil, although it can admittedly occur in the South, where roots live through the winter. Heavy infection resulted from the application of viruliferous tobacco debris to the land shortly before setting. The control of mosaic must, therefore, depend on keeping all tobacco debris of the previous year's crop away from the bed and field; roguing the mosaic plants to prevent field spread; and having the hands and clothes of the workers, including the pockets, where they may carry fragments of viruliferous tobacco, thoroughly washed and brushed before handling the growing plants.

Köhler (E.). **Vergleichende Untersuchungen über die Ausbreitungsgeschwindigkeit verschiedener Stämme des X-Mosaik-Virus in der Tabakpflanze.** [Comparative studies on the velocity of spread of various strains of the X-mosaic virus in the Tobacco plant.]—*Z. PflKrankh.*, xlviii, 3, pp. 118–128, 3 graphs, 1938.

A tabulated account is given of the writer's experiments at the Biological Institute, Dahlem, Berlin, to determine the relative velocity of spread in tobacco plants of four strains of the X-virus of potatoes, viz., Ers m (identical with that formerly known as Ers 25), H 19 m, Cs A, and Mb 12 [*R.A.M.*, xvii, p. 264]. The Ers m and Mb 12 strains were found to migrate much more slowly through their hosts than H 19 m and Cs A, with the result that the plants inoculated with the two former acquire immunity from infection (probably only partial) by other X-strains at a much later period than those inoculated with H 19 m and Cs A. The protective action against other viruses exerted by Ers m appears to be only about half as powerful as that of H 19 m and Cs A, and a similar relationship prevails in respect of Mb 12.

These data place in a somewhat different light the writer's earlier conclusions as to the failure of Ers m and Mb 12 to confer on their hosts a capacity to resist infection by other X-strains. The two strains in question undoubtedly possess the same defensive mechanism as the others under investigation, such differences as exist being merely of degree. It is further doubtful whether differences of this order can properly be used to maintain the existence of two subgroups (J. Johnson and Koch's mottle and ring spot, and Köhler's X_I and X_{II}) within the X-virus. In this connexion it is important to note that, in all the strains tested, the virus is particularly slow in penetrating to the leaf immediately above that selected for inoculation, conveying a misleading impression in immunization experiments unless this fact is borne in mind.

Basset (J.), Gratia (A.), Macheboeuf (M.), & Manil (P.). **Action of high pressure on plant viruses.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 2, pp. 248–251, 1 diag., 1938.

In experiments [? at the State Agricultural Institute, Gembloux,

Belgium] to test the resistance of certain plant viruses to high pressures, active, specific tobacco mosaic virus protein, obtained by differential ultracentrifugation, was divided into five parts, one of which remained untreated for control purposes while the others were pressed for 45 minutes at 2,000, 4,000, 6,000, and 8,000 atmospheres, respectively. The control and each of the four pressed samples were then divided into three portions, to the first of which was added an equal volume of anti-tobacco mosaic serum for the flocculation tests; to the second a quarter volume of saturated ammonium sulphate solution containing 5 per cent. acetic acid for the crystallization test, while the third was inoculated into *Nicotiana glutinosa* leaves for the virulence test. The following results were obtained. The control and the samples pressed at 2,000, 4,000, and 6,000 atmospheres responded very similarly to the flocculation test, i.e., by the development of a heavy precipitate in the form of a gel, closely resembling a slowly retracting clot, whereas the precipitate formed by the sample pressed at 8,000 atmospheres was of a totally different character, being reduced to a few small clumps readily undergoing sedimentation. The crystallization test likewise gave similar results for the control and the three first pressed samples, while that submitted to 8,000 atmospheres exhibited an amorphous precipitate in which only a very few crystalline forms could still be detected. The virulence test gave the following number of lesions: 90, 49, 63, 58, and 2 for the control and the four pressed portions, respectively. It is apparent from these data that the specific protein resists the influence of pressure up to 6,000 atmospheres but undergoes a marked change at 8,000.

The second experiment was performed comparatively with plain unpurified juices of tobacco plants infected either with the tobacco mosaic or tobacco necrosis virus [*R.A.M.*, xvi, p. 637], the latter being neutralized by the corresponding antiserum but showing no precipitation and hitherto unobtainable as a crystalline protein. In the virulence test for tobacco necrosis on tobacco, the control sample and that pressed at 3,000 atmospheres gave [an unspecified number of] lesions, whereas none developed from the 5,000 and 8,000 atmosphere samples. In the case of tobacco mosaic on *N. glutinosa*, the numbers of lesions produced by the control, 3,000, 5,000, and 8,000 atmosphere samples were 60, 121, 90, and 39, respectively.

In respect of the tobacco mosaic virus, the outcome of the second test is stated to confirm that of the first, both showing the destructive action of pressure exceeding 8,000 atmospheres, which is well above the usual lethal pressure for certain viruses and close to the denaturing pressure for globulin. On the other hand, tobacco necrosis virus is inactivated between 3,000 and 5,000 atmospheres, the usual virus lethal pressure.

Ross (A. F.) & Stanley (W. M.). **Partial reactivation of formolized Tobacco mosaic virus protein.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 2, pp. 260–263, 1938.

Samples of tobacco mosaic virus protein inactivated at room temperature in reaction mixtures containing 2 per cent. purified virus protein and 2 per cent. formaldehyde [*R.A.M.*, xv, p. 754] in M/10 phosphate

at P_H 7 were removed after varying periods and immediately dialysed against cold distilled water for about six hours in order to stop the reaction by the removal of excess formaldehyde. Dialysis at P_H 3 gave the best results and, since very little change occurred after the third day, a three-day period was adopted for the reactivation procedure. The dialysed solutions of inactivated and reactivated virus protein were adjusted to M/10 phosphate (P_H 7), analysed for total nitrogen, and diluted with M/10 phosphate to concentrations suitable for inoculating against controls containing 10^{-5} or 10^{-6} gm. active protein per c.c.

Nicotiana glutinosa was chosen as the test plant and the half-leaf method of inoculation [ibid., xvii, p. 272] was used, except in the trials for complete or almost complete reactivation, for which whole leaves were employed. The relative activities were interpreted after comparison with dilution curves of active virus and of mixtures of active and inactive virus proteins. Inactive protein was found to reduce the lesion count by 40 to 50 per cent. at a concentration of 10^{-2} gm. per c.c., but had very little effect at 10^{-3}. This reduction was no greater than that caused by comparable amounts of hydrogen peroxide-inactivated virus protein or of egg albumin. Inactivation by formaldehyde cannot be due to an aggregation of particles, for the formolized virus protein has about the same sedimentation constant [ibid., xvi, p. 415] and exhibits approximately the same amount of stream double refraction as does active virus protein. Formaldehyde inactivation causes a decrease in amino-nitrogen and is further accompanied by a decrease in the number of groups (probably the indole nuclei of tryptophane) reacting with Folin's phenol reagent. That formaldehyde is actually bound to the protein is indicated by the fact that, even after many days of dialysis, the formolized proteins give a strong Rosenheim-Acree reaction on the addition of sulphuric acid and an oxidizing agent. These results, together with the fact that during the inactivation of some 99 per cent. of the virus protein the rate approaches that of a monomolecular reaction, are considered to demonstrate that the inactivation is not due to the toxicity of free formaldehyde or of the protein-formaldhyde complex, and that it is probably a sequel to the blocking of amino groups, indole nuclei, or both.

When the reaction was stopped after appropriate periods, preparations retaining about 10, 1, and 0·1 per cent. of their original activity were secured. Following reactivation, these preparations were found to possess approximately 20, 10, and 1 per cent., respectively, of their original activity. Preparations that were inactive when inoculated at a concentration of 10^{-3} gm. per c.c. were appreciably infectious at the same strength after reactivation. The data indicate that two simultaneous reactions occur, one reversible and the other irreversible. The tenfold increase in activity obtainable by the reactivation process is definite and reproducible at will. Evidence that the process in question is accompanied by an increase in amino-nitrogen and in groups reacting with the phenol reagent was obtained by colorimetric estimation.

The demonstration that the addition of formaldehyde to the virus protein results in a simultaneous decrease of activity of amino and reducing groups, and that under conditions favourable to formaldehyde removal virus activity is regained and the number of such groups

increases denotes that some of the latter are at any rate partially concerned in the structural development necessary for virus activity. The formolized virus protein, unlike that inactivated with safranin [ibid., viii, p. 407] or the salts of heavy metals [ibid., xvii, p. 273], is soluble, and it has been proved that the inactivation is not due to toxicity. The inactivation of the virus by formaldehyde, its subsequent reactivation, and the condition of certain groups in each case can best be interpreted in terms of familiar chemical reactions, and constitute direct experimental evidence that virus activity is a specific property of the protein.

Bawden (F. C.) & Pirie (N. W.). **The isolation and some properties of liquid crystalline substances from Solanaceous plants infected with three strains of Tobacco mosaic virus.**—*Proc. roy. Soc.*, Ser. B., cxxiii, 832, pp. 274–320, 4 figs., 1 graph, 1937.

The authors isolated nucleoproteins with characteristic optical properties from Solanaceous plants infected with the mild strain of tobacco mosaic, aucuba mosaic [tobacco virus 6], and [tomato] enation mosaic [strain of tobacco virus 1: *R.A.M.*, xvii, p. 77], while no such proteins have been isolated from healthy plants. These nucleoproteins were found to be infective at a dilution of $1/10^{10}$ and to give specific precipitates with antisera at a dilution of $1/10^{7}$. When the protein content of the highly purified solutions was raised above about 2 per cent. they separated into a lower layer, which was the more concentrated and bi-refringent, and an upper layer, which showed anisotropy of flow. The two layers showed no essential difference in virus activity, expressed in terms of solid content. Anisotropy of flow was easily recognized in solutions containing only 0·02 per cent. of protein. High-speed centrifuging causes the protein to be deposited in the form of a bi-refringent jelly. Drying experiments resulted in a reduction of activity; heating to temperatures of 75° to 80° C. led to a rapid decomposition of the solutions and heating for a few minutes at 90° to 95° caused a complete loss of anisotropy of flow and destroyed the infectivity and the serological activity of the virus preparations.

The physical properties of the preparations and the X-ray measurements are discussed and it is suggested that the constituent particles in purified preparations are rod-shaped and are built up by the linear aggregation of smaller units. The results of filtration experiments with the virus before and after purification indicate that the degree of aggregation is greater in purified preparations than in the untreated infective sap. The authors are inclined to believe that the isolated nucleoproteins are the viruses themselves, there being strong presumptive, although not conclusive, evidence to this effect.

Fawcett (G. L.). **La corcova del Tabaco y su presencia en las plantaciones de Tomates.** ['Corcova' of Tobacco and its presence in Tomato plantations.]—*Circ. Estác. exp. agríc. Tucumán* 60, 2 pp., 1938.

It was experimentally established in 1937 that the transmission of the 'corcova' ['hunchback'] disease of tobacco and tomato in Tucumán, Argentine Republic [*R.A.M.*, xiii, p. 686], from diseased to healthy

plants is effected by a Thysanopterous insect, *Frankliniella paucispora* Moult. At the optimum temperature for the development of the disease (25° to 30° C.) the incubation period for viruliferous individuals on healthy plants is less than a week, but if a temperature of 35° or above is maintained for several hours daily the symptoms appear slowly or not at all. The larvae of *F. paucispora* proved more reliable than adults as vectors of 'corcova'. Reasonably early sowing of tobacco (in time for transplanting in September or early October) has been found to hold the disease in check; tomato seed should not be sown before May.

The principal symptoms of 'corcova' on tomatoes are a bronze discoloration of the leaves, either spreading uniformly over the surface or localized in figures or concentric spots. The affected foliage withers and severely diseased plants die; if fruit is produced it is small and of poor quality. The stems may show black lesions.

Wickens (G. M.). **A new and serious disease of Tobacco in S. Rhodesia. Preliminary note.**—*Rhod. agric. J.*, xxxv, 3, pp. 181–184, 1 pl., 1938.

During 1936–7, tobacco in Southern Rhodesia became affected by a new disease which appears to be able to spread rapidly and cause very serious loss. The affected plants show severe stunting of the main stem and marked distortion of the young leaves. When young plants are attacked the main stem ceases growth almost entirely, the leaves becoming distorted rather suddenly, with the result that the plants assume a rosette appearance, with healthy leaves spread out horizontally all round and the very small, distorted, younger leaves forming a tightly bunched knot in the centre. If the plants do not adopt this rosette formation, or if they grow out of it, the main stem makes some growth but remains somewhat stunted, and the leaves are small and distorted, the blades curling sharply under at the tips. Plants attacked when rather older are often more severely affected on one side than the other, the flower bending over and sometimes pointing to the ground. The available evidence indicated that the condition is of virus origin and is transmitted by *Myzus persicae*; it is not transmissible by handling.

It is recommended that all affected plants (including hosts other than tobacco, if found) should be removed and destroyed.

Anderson (P. J.). **Downy mildew of Tobacco.**—*Bull. Conn. agric. Exp. Sta.* 405, pp. 61–82, 5 figs., 1937. [Abs. in *Exp. Sta. Rec.*, lxxviii, 5, p. 648, 1938.]

This bulletin gives full information on downy mildew of tobacco (*Peronospora tabacina*) [see above, p. 503], including the history, symptoms, host range, and control of the disease, the effect of meteorological conditions, and a bibliography of 62 titles.

Clayton (E. E.) & Gaines (J. G.). **Blue mould (downy mildew) disease of Tobacco.**—*Fmrs' Bull. U.S. Dep. Agric.* 1799, 16 pp., 9 figs., 1938.

This is a popular account of the symptoms, life-history, and distribution of downy mildew of tobacco (*Peronospora tabacina*) [see preceding

abstract]. Control measures are discussed and both heat treatment and benzol gas treatment are considered too costly. The authors recommend such cultural practices as planting very large seed-beds and delaying transplanting until the diseased plants have recovered, and also spraying with red copper oxide.

Reid (J. J.), McKinstry (D. W.), & Haley (D. E.). **Studies on the fermentation of Tobacco. I. The microflora of cured and fermenting cigar-leaf Tobacco.**—*Bull. Pa agric. Exp. Sta.* 356, 18 pp., 2 graphs, 1938.

This is an expanded, tabulated account of the writers' studies on the microflora of cured Pennsylvania cigar-leaf tobacco foliage and its relation to catalase activity, a preliminary note on which has already appeared [*R.A.M.*, xvii, p. 211].

Bawden (F. C.) & Pirie (N. W.). **A plant virus preparation in a fully crystalline state.**—*Nature, Lond.*, cxli, 3568, pp. 513–514, 1938.

The authors succeeded in isolating a specific protein, which crystallized in the form of rhombic dodecahedra, from tomato plants infected with the virus causing bushy stunt [*R.A.M.*, xvi, p. 727]. This protein appears to be a nucleoprotein but has a rather higher nucleic acid content than those previously isolated from plants infected with other viruses. Solutions of the protein showed no anisotropy of flow, the crystals were also isotropic, and the jelly formed by sedimenting the protein in a centrifugal field of 16,000 times gravity was not bi-refringent. The protein was isolated from the infective sap, after clarification by heating to 60° C. and centrifuging, by repeated precipitations at room temperature with one quarter saturated ammonium sulphate solution. It was possible to fractionate impure preparations by means of trypsin or a high-speed centrifuge. Crystallization was best effected by adding ammonium sulphate to a neutral solution at room temperature until the appearance of the first sign of turbidity, immediately cooling to 0° C., and then slowly warming to room temperature. The protein was more soluble at 0° than at room temperature and it crystallized when the clear fluid was warmed. Analyses of dried preparations gave the following results: carbon 47, hydrogen 7·3, nitrogen 16, phosphorus 1·3, and carbohydrate 6 per cent. Infections in the form of local lesions were produced by rubbing the leaves of *Nicotiana glutinosa* with 1 c.c. of solutions containing 10^{-7} gm. of this protein, and 1 c.c. of solutions containing 10^{-6} gm. gave a visible precipitate with its antiserum. The activity of a preparation was unchanged by repeated recrystallizations or by sedimentation in a high-speed centrifuge.

Kadow (K. J.), Anderson (H. W.), & Hopperstead (S. L.). **Control of Sclerotinia and Botrytis stem rots of greenhouse Tomatoes and Cucumbers.**—*Phytopathology*, xxviii, 3, pp. 224, 226–227, 1 fig., 1938.

Under Illinois conditions the stem and fruit rots and blossom blight of greenhouse cucumbers and tomatoes caused by *Sclerotinia libertiana* [*S. sclerotiorum*] and *Botrytis cinerea* [*R.A.M.*, xi, p. 621; xvii, p. 418] are ordinarily of little importance, but during the damp, cloudy spring

of 1935 the losses from these diseases in the Chicago area amounted to between 60 and 75 per cent., while the total reduction for Cook County averaged 15 to 20 per cent. The treatment usually recommended for the control of the fungi (soil sterilization and spraying with 4–4–50 Bordeaux mixture) not being altogether reliable, a new method was devised involving the application to the cavities formed by the excision of diseased stem tissue of a thick Bordeaux paste consisting of 1 part of copper sulphate to 2 of lime-sulphur and water as required. This procedure is equally successful on both tomatoes and cucumbers, though the latter may react by slight foliar chlorosis. No absolutely effective means of combating *B. cinerea* on cucumber and tomato blossoms and fruits has yet been found, but the fungus causes much less damage to these organs than to the stems.

KALANDRA (A.) & PFEFFER (A.). **Duležitejsi a pozoruhodnejsi poskození, choroby a škudci lesnich dřevin v letech 1935–1936 v Československu.** [The most important and noteworthy troubles, diseases, and pests of forest trees in Czechoslovakia in the years 1935–6.] —*Ochr. Rost.*, xiv, 55, pp. 24–33, 1938. [German summary.]

In the first section of this report Kalandra gives a briefly annotated list of the more important physiological troubles and fungal diseases which were recorded in 1935–6 on forest trees in Czechoslovakia, and among which the following may be mentioned. In some nurseries first-year seedlings of *Picea excelsa* [*P. abies*] were badly attacked by a blight associated with *Fusarium* spp., and those of *Pinus sylvestris* were very extensively killed by *Botrytis cinerea*. *Ascochyta piniperda* [*R.A.M.*, xv, p. 618] was found associated with a die-back of *P. abies* shoots, and *Cytospora* sp. with areas of dead bark on the trunk of middle-aged trees. *Thelephora laciniata* [ibid., x, p. 271] caused fairly severe damage to young trees of *P. abies* and *Abies alba*. In one locality the cones of *P. abies* were severely attacked by rust (*Aecidium strobilobium*). *Lophodermium pinastri* [ibid., xvi, p. 847; xvii, p. 360] was extremely destructive on two-year-old *Pinus sylvestris* seedlings throughout the country, but was of minor importance on those of *P.* [*nigra* var.] *austriaca*. In one locality *Phoma abietis* was found killing the shoots of young *A. alba* trees. While apparently on the decrease, the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [ibid., xvi, p. 424] is still fairly prevalent in certain localities, and is correlated with the epidemic occurrence of bark beetles (*Scolytus scolytus*, *S. multistriatus* [ibid., xvii, p. 141], and *S. pygmeus*). In south Bohemia Canadian poplar (*Populus canadensis*) was observed to be attacked by *Cytospora chrysosperma* [ibid., xvi, p. 797], this being apparently the first record of the fungus from Czechoslovakia. Oak railway sleepers were observed in Prague to be heavily rotted by *Stereum frustulosum* [ibid., xvi, p. 4].

LA FUZE (H. H.). **Specificity of three wood-destroying fungi for Gymnosperm and Angiosperm woods.**—*Proc. Ia Acad. Sci., 1936*, xliii, p. 157, 1937. [Received May, 1938.]

Certain differences in the nutritional characteristics of *Polyporus betulinus* [*R.A.M.*, xiii, p. 604], *Polystictus versicolor* [ibid., xvi, pp. 221, 580, *et passim*], and *Fomes pinicola* [ibid., xiv, pp. 193, 795] appear

from studies at the Iowa Department of Botany to be correlated with divergences in the chemical analyses of Gymnosperm and Angiosperm woods. In this connexion special mention may be made of the water-soluble extractives containing simpler carbohydrates and the pentoses in coniferous woods, the most frequent hosts of *F. pinicola*. Both this organism and the birch fungus, *Polyporus betulinus*, showed high reductase activity, a phenomenon reported to be common among the brown rot fungi on Gymnosperm, birch, and alder woods. On the other hand, *Polystictus versicolor*, which attacks a wide variety of Angiosperm woods in nature, displayed a high oxidase activity and uniform growth on various carbohydrates in artificial nutrient media.

W.P.A. crews find copper sulphate effective against Dutch Elm disease. —*J. For.*, xxxvi, 3, p. 342, 1938.

Excellent results are stated to have been obtained by employees of the Works Progress Administration in New Jersey in the control of Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvii, p. 278] by packing copper sulphate into a narrow strip of sapwood, which is then re-covered by bark and a patch of oilcloth applied. The tree is usually killed, and with it the fungus and its carrier beetles [*Scolytus scolytus* and *S. multistriatus*], in five or six days. This method of control has been chiefly used in the wooded rural areas of the State, where 80 per cent. of the infected trees are found. The campaign against the Dutch elm disease in New Jersey is being waged by 2,824 workers, and so far the sum of $438,474 out of a total of $1,095,000 allocated for the purpose has been spent.

ROBERG (M.). **Über den Erreger der Wurzelknöllchen europäischer Erlen.** [On the agent of the root nodules of European Alders.]—*Jb. wiss. Bot.*, lxxxvi, 3, pp. 344–349, 1938.

The results of cross-inoculation experiments in 1936 and 1937 at Breslau, Germany, on alder seedlings in a synthetic nutrient solution with a suspension of ground root nodules isolated from each of four species, viz., *Alnus glutinosa*, *A. incana*, *A. cordata*, and *A. viridis*, showed that *Actinomyces alni* [*R.A.M.*, xvi, p. 562] was responsible in all cases for the formation of the rhizothamnia. Only healthy seedlings reacted to inoculation by nodule production.

BLATTNÝ [C.]. **Virová choroba 'maly list' a pohárovitost listů Lipy.** [The virus disease 'little leaf' and cup-like malformation of the leaves of Lime trees.]—*Ochr. Rost.*, xiv, 55, pp. 80–81, 1938. [German summary on p. 98.]

The author states that in several localities in Bohemia, Czechoslovakia, he observed in small-leaved lime trees (*Tilia cordata*) a condition which he descriptively terms 'little leaf' as it is characterized by a very severe stunting of the foliage, associated with interveinal discolorations; the disease may affect separate sections of a tree or whole trees, the diseased portions occasionally failing to produce flowers; in bad cases the condition may terminate in the death of the tree or of the affected branches. The fact that the disease symptoms were reproduced in branches of healthy trees, into which bast tissues of diseased

trees were introduced, is held to demonstrate that the condition is caused by a virus. Large-leaved lime trees (*T. grandifolia*) [*T. platyphyllos*] growing in close proximity to diseased *T. cordata* did not develop symptoms of 'little leaf', but their leaves assumed a cup-like shape, frequently with the edges united. Histological studies of such trees indicated the probability that this condition is also due to a virus, possibly related to that of 'little leaf'.

VAN VLOTEN (H.). **Het onderzoek naar de vatbaarheid van Populieren voor aantasting door Dothichiza populea Sacc. et Briard (eerste verslag).** [The inquiry as to the susceptibility of Poplars to attack by *Dothichiza populea* Sacc. & Briard (preliminary report).]—Reprinted from *Tijdschr. ned. Heidemaatsch., 1938*, 3, 18 pp., 4 figs., 2 graphs, 1938. [English summary.]

Particulars are given of the preliminary results in a series of experiments, which is in progress in Holland, to determine the specific reaction of poplars to infection by *Dothichiza populea*, this name being retained in preference to Klebahn's proposed *Chondroplea populea* [*R.A.M.*, xvi, p. 572] on account of the incomplete description of spore formation in the latter.

Inoculation during the dormant stage gave rise to more severe symptoms than those developing when the operation was deferred until growth had started. Cuttings and newly transplanted trees sustained the heaviest damage. On the whole, the Tacamahac group [*Populus tacamahacca*] proved to be more susceptible to *D. populea* than representatives of the Aigeiros category, but *P. candicans* and *P. berolinensis* showed a fair degree of resistance. Most of the hybrids developed in the United States by Stout and Schreiner were also susceptible, some degree of resistance being shown, however, by the Rumford (*P. nigra* × *P. laurifolia*), Maine (*P. candicans* × *P. berolinensis*), and Andover (*P. nigra* var. *betulifolia* × *P. trichocarpa*) poplars. Within the Aigeiros group the most resistant species were *P. fremontii*, *P. brabantica*, *P. marilandica*, *P. eugenei*, *P regenerata*, and *P. serotina* var. *erecta*.

MALENÇON (G.). **L'Hypoxylon sertatum D.R. et Mtgn., parasite des Chênes-liège marocains.** [*Hypoxylon sertatum* Dur. & Mont., a parasite of Moroccan Cork Oaks.]—*Bull. Soc. Sci. nat. Maroc*, xvii, 2, pp. 127–131, 1937.

Hitherto the only two virulent fungal pathogens of the cork oak [*Quercus suber*] known in Morocco were *Xanthocrous* [*Polystictus*] *cuticularis* and *Ungulina fomentaria* [*Fomes fomentarius*: *R.A.M.*, xvi, p. 4], but a third parasite causing even more severe damage has recently been detected in the Mamora forest, near Rabat. *Hypoxylon sertatum* enters the host through the outermost twigs, the tips of which wither and die, and thence gradually proceeds along the larger branches to the trunk; at this stage the attack generally assumes a destructive character and the tree rapidly succumbs. Fusoid longitudinal fissures, up to 50 to 60 by 4 to 8 cm., soon develop on the dead areas of the branches or trunk; the base of the cracks is occupied by the carbonaceous stroma of the fungus, dull black at first, later glistening as the

finely papillate, globose or oval spores, 5 to 8 μ in diameter, are extruded through the perithecial ostioles.

Infection appears to take place through the wounds, frequently inflicted on the young, growing tissues during humid spring weather by *Lymantria dispar*. Once entry to the host is gained, the mycelium produces in the cortical tissues two groups of brown, septate, fairly coarse hyphae, one consisting of nearly straight elements which penetrate into the depths of the cortex and rapidly proceed through the phloem down the branch towards the trunk. The hyphae of the second category, arising perpendicularly from the foregoing, pursue an erratic course, and frequently form fresh hyphae of the first type which invade the suberophellodermic layer. These separate phases of infection can only be recognized in the initial stages of invasion; later all the cortical tissues except some sclerotic cells become disorganized, the dead tissues soon developing a typical black discoloration. Finally the parasite enters the xylem, usually through the medullary rays, but the only effects on this portion of the host are a slight softening and the formation of brown or blackish lines.

The author proposes a new section of *Hypoxylon* named *Cryptoxylon* to take this species, which, though new to the flora of Morocco, has been reported on cork oak from Algeria and on one occasion on a walnut from France; it was further observed in January, 1937, on a fallen branch of *Eucalyptus robusta* at Rabat.

Direct control measures being obviously impracticable on a large scale, attention should be directed towards general silvicultural hygiene, followed if necessary by the substitution of pines or some other immune species for *Q. suber*.

KALANDRA (A.). **Nová sypavka u nás působená houbou Hypodermella sulcigena (Rostr.) Tub. na Borovici obecné a Kleči v Tatrách a na Šumavě.** [A leaf-cast disease new to our country caused by *Hypodermella sulcigena* (Rostr.) Tub. on Scots Pine and Mountain Pine in the High Tatra and Šumava.]—*Ochr. Rost.*, xiv, 55, pp. 38–46, 1 pl., 1938. [English summary.]

A brief account is given of an outbreak in 1936–7, apparently the first recorded in Czechoslovakia, of *Hypodermella sulcigena* [*R.A.M.*, xii, p. 255] on *Pinus sylvestris* and *P. montana* in some mountain districts of the High Tatra, Slovakia, and Bohemia. In a few rare instances mature apothecia of the fungus were found in association with mature pycnidia of *Hendersonia acicola* [ibid., ix, p. 146] on the same pine needles. Infected needles received from the High Tatra showed a much more abundant association of *Hypodermella sulcigena* with a pycnidial fungus probably identical with *Hendersonia montana* Vuill. The fact that the majority of the pycnidia were observed to be formed inside the tissues of the developing apothecia of *Hypodermella sulcigena* inclines the author to believe that they are the conidial stage of the latter. The pycnidia are light brown to dark brownish black, more or less globose, with a prominent ostiole, and mostly 82 (rarely 41) to 168 μ (exceptionally 256 to 352 μ) in diameter. The pycnospores are hyaline, later yellowish- to olivaceous-brown, straight to slightly curved, one- to five-celled (usually four-celled), slightly constricted at the septa, and 24 to

55 by 3 to 6 μ (mostly 27 to 36 by 4 to 5 μ) in diameter. It is believed that heavy outbreaks of the disease may be controlled with applications of Bordeaux mixture.

FAULL (J. H.). **Pucciniastrum on Epilobium and Abies.**—*J. Arnold Arbor.*, xix, 2, pp. 163–173, 1938.

This is a study of two species of *Pucciniastrum*, both of which develop their haploid phase on *Abies balsamea*, viz., *P. abieti-chamaenerii* Kleb. from *Epilobium angustifolium*, belonging to the subgenus *Chamaenerion* of *Epilobium*, and the rust conveniently designated *P. epilobii* Otth apud Sydow from *E. adenocaulon*, belonging to the subgenus *Lysimachion*. The life-history of the latter rust is recorded in this paper for the first time. The results of inoculation experiments [which are described in detail] show that the rust originating from *E. angustifolium* does not infect *E. adenocaulon* either by aecidiospores or uredospores, nor can the rust originating from the latter host infect the former. The aecidia of the *E. angustifolium* rust are 0·012 to 0·025 mm. in diameter and have fragile peridia and very finely warted aecidiospores, averaging 15 by 19 μ, while those of that from *E. adenocaulon* measure 0·02 to 0·04 mm. in diameter and have a persistent peridium, and subcoarsely warted aecidiospores, 14 by 18 μ. The corresponding uredospores average 16 by 19 μ and 14 by 19 μ, with peridial cells up to 1·5 and 2·5 μ, respectively, in thickness. Apart from these morphological distinctions, the two rusts exhibited the following differences. The *E. angustifolium* rust occurred more frequently and more severely on the needles of the upper part of the current season's growth, while that from *E. adenocaulon* rust occurred more often on the lower part of it, the peridermia were produced within an average of 17 and 20 days after inoculation by the two rusts, respectively, and the average number of peridermia per infected needle were 33 and 27, respectively. Field experience and controlled cultures showed that *A. balsamea* is highly susceptible to these rusts, which often cause severe damage to young trees.

Discussing the somewhat unsettled taxonomic situation the author considers that these two rusts should be nomenclatorially differentiated, preferably as distinct species, and proposes that the name *P. abieti-chamaenerii* Kleb. be retained for the *E. angustifolium* rust and the usual *P. pustulatum* (Pers.) Diet. in part adopted for that from *E. adenocaulon* rust, since it seems probable that Otth's material was the rust on *E. angustifolium*.

HIRT (R. R.). **Relation of stomata to infection of Pinus strobus by Cronartium ribicola.**—*Phytopathology*, xxviii, 3, pp. 180–190, 2 figs., 1938.

Full details are given of inoculation experiments with *Cronartium ribicola* on white pine (*Pinus strobus*) needles [see next abstract] at two localities in New York State, which resulted in the direct penetration of the epidermal cells by sporidial germ-tubes, herein reported for the first time. Penetration occurred through both dorsal and ventral surfaces of the needles and the germ-tubes either retained their normal width in passing through the cell walls or formed a fine, needle-like

extension at the tip; no appressorium was formed and no swelling of the germ-tubes within the tissues was observed. Stomatal activity appears to be of little or no importance in relation to blister rust penetration, none of the germ-tubes having grown through a stomatal pore into a needle but having rather tended to develop along the epidermal surface in another direction. The negative results of these observations do not of course exclude the possibility of stomatal penetration by *C. ribicola*, but merely point to direct epidermal infection as the more common method of attack.

BUCHANAN (T. S.). **Blister rust damage to merchantable western White Pine.**—*J. For.*, xxxvi, 3, pp. 321–328, 1 graph, 1938.

To procure data on the nature of white pine (*Pinus monticola*) blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 494] infection and probable damage to merchantable stands the Division of Forest Pathology examined three infested areas in British Columbia in 1927 [ibid., xiv, p. 66], a total of 534 trees, 5 to 16 ft. in height, constituting the basis. With a view to comparing the results with Inland Empire conditions, 12 infected trees, 66 to 192 ft. in height, were critically inspected in 1936 in the Clearwater region of Idaho.

The outcome of these combined studies shows that infection may take place in the crowns of even the tallest trees, while under conditions favouring the rust, 50 per cent. or more of the merchantable timber in a stand may suffer damage from a relatively short period of exposure (six years) to blister rust on *Ribes* (*R. lacustre*, *R. divaricatum*, and *R. bracteosum* in British Columbia, *R. petiolare* and *R. viscosissimum* in Idaho).

YORK (H. H.). **Inoculations with forest tree rusts.**—*Phytopathology*, xxviii, 3, pp. 210–212, 1 fig., 1938.

In June, 1927, about 200 shoots each of *Pinus resinosa*, *P. sylvestris*, *P. radiata*, and *P. ponderosa* were inoculated near Woodgate, New York, with aecidiospores of the Woodgate rust (*Peridermium* sp.) [*R.A.M.*, xvii, p. 422] by means of a celluloid cone, 22 in. in length and 3 and 1½ in. in diameter at the two ends, which was slipped over the infected parts and anchored to the stem by means of a copper wire. A strip of absorbent cotton, 8 to 10 by 1 in., saturated in water, was pushed through the narrower end well down the inside of the cone, the entire outer surface of which was wrapped with wet absorbent cotton to a thickness of 1 to 1½ in. The cones were left on the shoots for 24 to 36 hours.

Within four to six weeks infection spots appeared on the stems of all the species of pine used in the test, those on *Pinus sylvestris* frequently being so abundant as to colour the whole stem surface reddish-brown by the end of August. Aecidiospore germination was much more profuse in the inoculation chambers (75 per cent.) than in water cultures (25 per cent.), and anastomosis was considerably more extensive in the former case. It is possible that the Woodgate rust may prove to be one of the western gall group, the alternate hosts of which are members of the Scrophulariaceae, but inoculation experiments on two of the

latter (*Chelone glabra* and *Scrophularia leporella*) with aecidiospores gave negative results.

The celluloid chamber technique also proved very convenient and reliable for inoculation experiments with *Cronartium ribicola* [see preceding abstracts].

CRANDALL (B. S.). **A root and collar disease of Pine seedlings caused by Sphaeropsis ellisii.**—*Phytopathology*, xxviii, 3, pp. 227–229, 1938.

During the investigation of the root disease of *Pinus resinosa* seedlings in Maryland due to *Phytophthora cinnamomi* [*R.A.M.*, xvi, p. 159], many of the 3- to 5-year-old seedlings in two nurseries were found to be suffering from an atypical foot rot characterized by a deep red discoloration of the bark tissue, with black streaks continuing into the xylem and often persisting throughout the entire stele. Similarly affected 5- or 6-year-old *Pinus strobus* trees were received from a Wisconsin plantation. The fungus isolated from the diseased *P. resinosa* and *P. strobus* tissues was identified by N. E. Stevens as *Sphaeropsis ellisii* [*Diplodia pinea*: ibid., xvi, pp. 75, 787], hitherto associated exclusively with a twig die-back of various conifers. In inoculation experiments both *D. pinea* and *Phytophthora cinnamomi* proved to be strongly pathogenic to 3-year-old *Pinus resinosa* seedlings, while less extensive infection was caused by *Pestalozzia funerea*; on the other hand, the controls inoculated with *Sclerotium bataticola* [*Macrophomina phaseoli*] and sterile rice remained healthy. In one test, *Phytophthora cinnamomi* invaded the tissues for an average of 7·5 cm. in each direction from the collar in 18 days, while *D. pinea* progressed 5·5 cm. downwards and 12 cm. upwards. In both cases all the infected seedlings were killed.

JESSEN (W.). **Phosphorsäuremangelerscheinungen bei verschiedenen Holzarten.** [Phosphoric acid deficiency symptoms in various kinds of trees.]—*Phosphorsäure*, vii, 3, pp. 263–270, 5 figs., 1938.

Details are given of experimental observations at the College of Forestry, Hann.-Münden, Germany, on a disturbance of larches, pines, and spruces due to phosphoric acid deficiency and manifested by a dark greyish- to bluish-green discoloration of the needles [*R.A.M.*, xvi, p. 357]. In the case of the larches and spruce this abnormal condition persisted until the autumn, occasionally accompanied in the spruces by a reddish-purple discoloration, whereas the tips of the pine needles turned crimson to purple in the late summer. Larches and pines in a forest soil receiving liberal applications of lime also showed definite symptoms of phosphoric acid deficiency. In general, the chemical analyses undertaken in connexion with these observations revealed no striking reduction of the phosphoric acid content of the soil and it is concluded that the phosphoric acid is presumably merely immobilized by the excess of lime.

CUMMINS (J. E.). **Some modern aspects of wood preservation.**—*Proc. Soc. chem. Industr., Vict.*, xxxvii, 5–8, pp. 1275–1296, 1937. [Received April, 1938.]

The writer critically surveys some outstanding recent developments

in the treatment of timber against fungi and insects, reference to most of which has been made from time to time in this *Review*.

TOMPKINS (C. M.) & THOMAS (H. R.). **A mosaic disease of Chinese Cabbage.**—*J. agric. Res.*, lvi, 7, pp. 541–551, 5 figs., 1938.

A mosaic disease of Chinese cabbage (*Brassica pe-tsai*) [*R.A.M.*, x, p. 504] was observed in 1934 in central California during the autumn and winter months, causing a slight stunting of the plant and a systemic clearing of the veins, followed by general mottling, with little or no distortion of the leaves. Greenhouse experiments showed that the disease was easily transmitted by the cabbage aphid (*Brevicoryne brassicae*) and the green peach aphid (*Myzus persicae*) and by means of mechanical inoculation with juice, using carborundum as an abrasive, but not through the seed; the incubation period was 13 to 22 days. The host range of the virus appeared to be confined to the Cruciferae, although local lesions were obtained on *Nicotiana glutinosa* and tobacco. The virus retained infectivity after storage for 3 but not for 4 days at 22° C.; after being diluted to 1 in 5,000 but not at 1 in 6,000; and after an exposure for 10 minutes at 73° but not at 75°. A comparative study of the symptoms produced by the Chinese cabbage, cauliflower, and turnip mosaic viruses on Chinese cabbage, Winter Colma cabbage, and Purple Top White Globe turnip showed that the viruses could easily be differentiated on these hosts.

HILLE (E.). **Betrachtungen über die Düngung der Zuckerrüben unter besonderer Berücksichtigung der Phosphorsäure und des Borsuperphosphats.** [Reflections on the manuring of Sugar Beets with special reference to phosphoric acid and boron superphosphate.]—*Zuckerrübenbau*, xx, pp. 37–45, 1938. [Abs. in *Chem. Zbl.*, cix (i), 19, p. 3680, 1938.]

The application of lime, green, liquid, and stable manures, nitrogen, phosphorus, and potash to German sugar beet crops is discussed. Phosphoric acid is considered to be particularly valuable as a means of increasing yield and sugar content, besides facilitating the sugar-manufacturing processes by raising the alkalinity of the cell juices. Heart and dry rot [*R.A.M.*, xvii, p. 286] may be practically suppressed by soil treatments with borax or boron superphosphate at the rates of 15 to 20 kg. and 300 to 400 kg., respectively, per hect.

SCHMIDT (HERTA). **Beitrag zur Kenntnis der Wirkung von Beizmitteln auf künstlich infizierte Gemüsesamen.** [A contribution to the knowledge of the effect of steeping materials on artificially infected vegetable seeds.]—*Gartenbauwiss.*, xii, 1, pp. 89–115, 8 figs., 1938.

Cucumber seeds used in steeping experiments were first artificially inoculated with *Cladosporium cucumerinum* [*R.A.M.*, xvii, p. 364] and *Gloeosporium lagenarium* [ibid., xvi, p. 228] and bean [*Phaseolus vulgaris*] seeds with *Colletotrichum lindemuthianum* [ibid., xvii, p. 5]; the wet method of inoculation, where the seeds were steeped for 10 to 15 minutes in a spore suspension and then dried on blotting-paper at room temperature, yielded better results than the dry method, where pieces of mycelium were put on the seeds. A decrease of infection, but not always complete control, was obtained by steeping the seeds in the

following materials: (*a*) wet: uspulun, ceresan, and fusariol at concentrations of 0·25 and 0·5 per cent., 15 minutes' immersion, and germisan at a strength of 0·125 per cent., 15 minutes; and (*b*) dry: ceresan at concentrations of 2 and 4 per cent., and fusariol, tutan, and abavit-neu at 2 per cent. In the case of *G. lagenarium* the best results were obtained with ceresan wet and dry and fusariol wet; in the case of the other two fungi equally good results were obtained with all the tested materials. The germinability of bean seeds infected with *C. lindemuthianum* was, however, under unfavourable conditions, distinctly decreased by tutan, fusariol dry, and possibly abavit.

FUKUSHI (T.). **The relation of aphids to the transmission of vegetable mosaics.**—*J. Sapporo Soc. Agric. For.*, xxix, 139, pp. 189–216, 5 pl., 1937.

In the course of his studies on the transmission of vegetable mosaics by *Myzus persicae*, following the first outbreak of a mosaic disease on pea and broad bean [*Vicia faba*] plants, grown in the vicinity of red clover [*Trifolium pratense*] plots in Sapporo in 1935, the author transmitted the red clover mosaic through the agency of *M. persicae* to French bean [*Phaseolus vulgaris*], pea, broad bean, red clover, crimson clover [*T. incarnatum*], and alsike clover [*T. hybridum*]; the pea disease to pea, broad bean, crimson clover, and alsike clover; and the broad bean disease to pea, broad bean, sweet pea, and red clover. In the case of pea, broad bean, red clover, and alsike clover the resulting symptoms were similar to those occurring in the field, but the symptoms developing on the French bean plants differed considerably from those of the bean mosaic. The aphids often acquired the virus after feeding for 5 minutes on diseased red clover, pea, and broad bean plants. Single aphids transmitted red clover mosaic virus to healthy pea plants within 10 minutes and similarly the broad bean mosaic to healthy broad bean plants within 30 minutes. The insects retained the red clover mosaic virus for about 30 minutes when allowed to feed, and for about one hour when kept without access to food plants; after this time the infectivity was gradually reduced and eventually lost after about 5 hours. It appears that this virus requires either a very short or no incubation period in aphids and is transmitted mechanically from diseased to healthy plants. It was found that only a small proportion of aphids was capable of transmitting the pea and broad bean virus. *M. persicae* was observed in the greenhouse to multiply abundantly on alsike clover and crimson clover and less readily on pea and broad bean, while red clover appeared to be an uncongenial food plant. It is uncertain whether under natural conditions *M. persicae* actually transmits the disease from alsike clover and red clover to pea and broad bean plants, but in view of the experimental results it is concluded to be not improbable.

ANDREYEFF (N. I.). Новая для Союза вирусная болезнь Лука. [A virus disease of Onion new to U.S.S.R.]—*Symp. Res. Wks, Azoff-Black Sea agric. Coll., Persianovka, 1937*, 5, pp. 125–130, 2 figs., 1937. [Received June, 1938.]

The author describes in full the symptoms of a virus disease of onion,

observed in 1934–5 at the plant-breeding station near Novocherkassk (Azoff-Black Sea Region), believed by him to be recorded for the first time in U.S.S.R. [but see *R.A.M.*, xvii, p. 91]. The disease is stated to resemble very strongly the 'Rotzkrankheit' disease in Germany [ibid., xvi, p. 724] and slime disease or yellow dwarf in the United States [ibid., xvii, p. 221], although the author is inclined to attribute the chlorotić appearance and occasional dwarfing of the flower stalk to the activity of mildew [*Peronospora schleideniana*: ibid., xvi, p. 651].

The Agricultural Pests Ordinance, 1917. (No. 2 of 1917.)—2 pp., 1938.

Under the 'Plant Importation Rules, 1938' (section 18 of the Agricultural Pests Ordinance, 1917), cancelling Gazette Notification 100 of 1933, permits from the Director of Agriculture are required for the importation into North Borneo of all plants, which must be accompanied by an official certificate of freedom from pest and disease or of fumigation. Scheduled plants, i.e., cotton, sugar-cane, coco-nut (seed nuts), living and growing palms, coffee, suckers of bananas (*Musa sapientum* and *M. cavendishii* or *M. chinensis*), plantains (*M. paradisiaca*), and abaca (*M. textilis*), oil palm seeds, tea (all parts including seeds), and suckers, tops, or other living organs of pineapple, must be accompanied by a duly authenticated certificate, in scheduled form, attested by the competent authority in the exporting country and vouching for the freedom of the plants from any injurious pest or disease. Sandakan and Jesselton are the sole authorized places of entry into North Borneo for plant consignments.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 2, pp. 40–41, 1938.

Lithuania. An Order of 18th December, 1937, prescribes that consignments of potatoes imported into Lithuania must be free from wart disease (*Synchytrium endobioticum*), must originate in countries exercising a rigid surveillance of imported material and in which wart disease has not been recorded during the last ten years, and must contain a total of not more than 3 per cent. infection by *Spongospora* [*subterranea*], *Actinomyces* [*scabies*], *Rhizoctonia* [*Corticium solani*], and *Phytophthora* [*infestans*], and 0·25 per cent. [unspecified] wet rot.

Efimoff (A. L.), Kazas (I. A.), Kradinova (Mme M. D.), Obolensky (V. N.), & Shtsherbinovsky (N. S.). Карантин растений в СССР. [Plant quarantine in U.S.S.R.]—*Publ. НКЗ СССР, Сект. внеш. и внутр. Каранп. Растений.* [*U.S.S.R. People's Commissariat Agric. Sect. intern. extern. Pl. Quar.*], *Moscow*, 254 pp., 84 figs., 1937. [Received June, 1938.]

This is a revised edition of the official list of insect pests and plant-pathogenic bacteria and fungi falling under the 1935 plant quarantine regulations [*R.A.M.*, xv, p. 399], supplemented by detailed descriptions of each disease, with notes on its geographical distribution, control measures, and quarantine regulations existing in other countries.